PROCEEDINGS
OF THE
CALIFORNIA ACADEMY OF SCIENCES
FOURTH SERIES

Vol. XLI, No. 12, pp. 307–337; 20 figs. February 8, 1978

EASTERN PACIFIC MACROURIDS OF THE GENUS *COELORINCHUS* GIORNA (PISCES: GADIFORMES), WITH DESCRIPTION OF A NEW SPECIES FROM CHILE

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ABSTRACT: Six eastern Pacific representatives of the speciose and widely distributed grenadier genus *Coelorinchus* are known. One of these, *C. aconcagua*, is herein described as new; it is a species of relatively shallow depths (175–428 m) and restricted distribution (off Chile between approximately latitudes 30° and 42° S). Three other species also have relatively restricted distributions: *C. scaphopsis* (southern California and northern Gulf of California); *C. canus* (northern Peru to Costa Rica); and *C. chilensis* (northern Chile to Peru). *C. innotabilis* and *C. fasciatus* are widely distributed in cold-water regions of the southern hemisphere; one Chilean specimen of the former represents a first record from the eastern Pacific. Five populations of *C. fasciatus* show slight morphological differences from each other; a clinal pattern is seen in several features from South America to South Africa to South-West Africa. *C. patagoniae* Gilbert and Thompson, 1916, is synonymized with *C. fasciatus*. *C. canus* and *C. scaphopsis* appear most closely related to western Atlantic species; *C. fasciatus* is widespread in the subantarctic and has close relatives in Australian waters; *C. innotabilis* appears most closely related to members of the subgenus *Paramacrurus* from the Philippines, East Indies, Japan, and Hawaii; the relationships of *C. chilensis* and *C. aconcagua* are obscure.

INTRODUCTION

This paper is the fourth in a series dealing with the systematics of macrourid fishes, or grenadiers, of the eastern Pacific Ocean. The first (Iwamoto and Stein 1974) dealt with 10 species of grenadiers of the northeastern Pacific north of San Francisco, California. The other two (Chirichigno and Iwamoto 1977; and Hubbs and Iwamoto 1977) reported new species from the eastern Pacific. The purpose of this paper is to treat systematically the six eastern Pacific representatives of the speciose genus *Coelorinchus*, discussing their relationships and distribution and describing one as new and another as a first record from the region.

MATERIAL AND METHODS

Papers of this series are based primarily on studies of the extensive material collected within the past two decades by vessels of several United States institutions. Collections made by oceanographic research vessels of Oregon State University formed the bulk of the material reported on by Iwamoto and Stein (1974) (most of that material is now housed at the California Academy of Sciences, CAS). The extensive midwater collections made by vessels of the Scripps Institution of Oceanography (SIO) and the University of Southern California (latter collections in Los Angeles County Museum of Natural History, LACM) formed the basis of the Hubbs and

Iwamoto (1977) article describing new bathypelagic grenadiers.

For the present article and for subsequent articles dealing primarily with species of the warm-water and southern-hemisphere regions of the eastern Pacific, the macrourids captured by the Smithsonian Institution's ANTON BRUUN are preeminent among recent collections. Representatives of at least 19 of the approximately 27 species known from the Pacific coast of South America were taken by that vessel in 1966 during cruises involved with the Southeastern Pacific Biological Oceanography Program. Supplementing the ANTON BRUUN collections are the substantial ones made by Stanford University's TE VEGA (collections housed in CAS), the University of Southern California's VELERO IV, and various vessels of the Scripps Institution of Oceanography.

Of all the eastern Pacific grenadier collections, those made by the United States Fish Commission steamer ALBATROSS around the turn of the century must stand foremost. Most of the ALBATROSS grenadiers from southern-hemisphere and warm-water regions of the eastern Pacific have already been treated by Garman (1899), Gilbert (1890; 1892), and Gilbert and Thompson (*in* Thompson 1916). Important collections made by that vessel in 1888 and 1904 in waters off the Galápagos, mainland Equador, and Panama have, however, never been reported on, although Dr. Carl. L. Hubbs (SIO) examined the material while a student at Stanford University and applied names (some new) to the specimens before returning most (some were retained at Stanford) to the National Museum of Natural History (USNM). Because of other commitments, he was never able to get back to complete a publication on them (Carl L. Hubbs, personal communication). Most of the ALBATROSS collections from the eastern Pacific are housed in the USNM, Museum of Comparative Zoology at Harvard University (MCZ), and CAS (CAS-SU refers to specimens formerly housed at the Natural History Museum of Stanford University).

Specimens examined from institutions other than those listed above and used for the present paper include: American Museum of Natural History, New York, N.Y. (AMNH), Gulf Coast Research Laboratory Museum, Ocean Springs, Mississippi (GCRL), Instituto del Mar, Callao, Peru (IMARPE), Musée Royal de l'Afrique Centrale, Tervuren, Belgium (MRAC), Museo Nacional de Historia Natural, Santiago, Chile (MNHN, Santiago), and South African Museum, Cape Town, South Africa (SAM).

Methods for making counts and measurements follow procedures outlined in a previous work (Iwamoto, 1970) and generally follow the methodology of Hubbs and Lagler (1958). Figure 1 illustrates how certain measurements were taken. Because of the importance of certain counts as diagnostic characters, methods for taking them are here described in detail:

First dorsal fin—counts include the two spinous anteriormost rays (the first of which is small, closely appressed to the long second ray, and scarcely discernible without dissection). They are designated in counts given in the text by Roman numerals but are not differentiated in the tables. The last two rays of the fin are usually unbranched, and each is included in the fin-ray count.

Pectoral fin—has a small splintlike uppermost ray which is designated by the letter i, in lower case, in counts given in the text but is not differentiated in the tables. The lowermost rays of the fin are very small and require substantial magnification and often teasing of the folds of the skin at the fin base to count them accurately.

Lateral-line scales over distance equal to predorsal length—the number of lateral-line scales, counted from the anterior origin of the lateral line, over a distance equal to that of the predorsal length.

Scales below 1D.—Scale rows above the lateral line, counted obliquely down and back from the origin of the first dorsal fin to the lateral line, but not including the lateral-line scale. The small size of the scales at the dorsal origin and the irregularity of rows there make accurate counts difficult. Designation of half scales in the counts indicates that the scale nearest the median line is much smaller than the adjacent lateral (lower) scale.

Scales below mid-1D., and below 2D.—taken in a similar manner as for scales below 1D. except, in the first case, the count is taken below the midbase of the first dorsal fin while, in the second case, it is taken below the origin of the second dorsal fin.

Gill-rakers—all rakers on the inner (medial) side of the arch, including rudimentary ones, on the upper and lower limbs are counted. In the text,

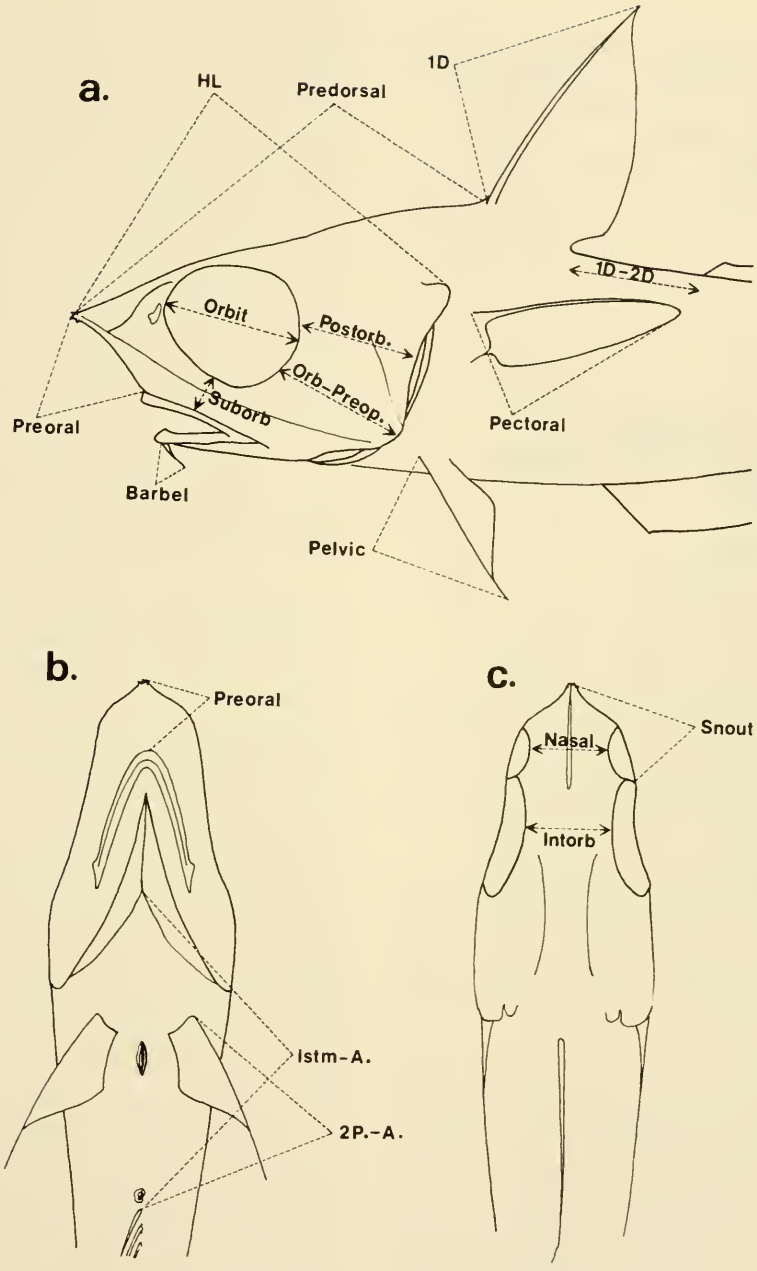

FIGURE 1. Methods for taking certain measurements in specimens of *Coelorinchus*: a) lateral view; b) ventral view; c) dorsal view. Abbreviations: Barbel—length of barbel; 1D.—height of first dorsal fin; 1D.–2D.—length of space between first and second dorsal fins; HL—head length; Intorb.—least width of interorbital space; Istm–A.—distance from isthmus to anal origin; Nasal—least (internasal) width between nasal ridges (taken from outer edge of ridges); pectoral—length of pectoral fin; Pelvic—length of pelvic fin; 2P.–A.—distance between base of outer pelvic ray and anal origin; Predorsal—predorsal length; Preoral—preoral length of snout; Postorb.—least postorbital length of head; Orbit—greatest orbit diameter; Orb–Preop.—distance between posterior margin of orbit and posterior margin of preopercle; Snout—length of snout; Suborb.—least width of suborbital region.

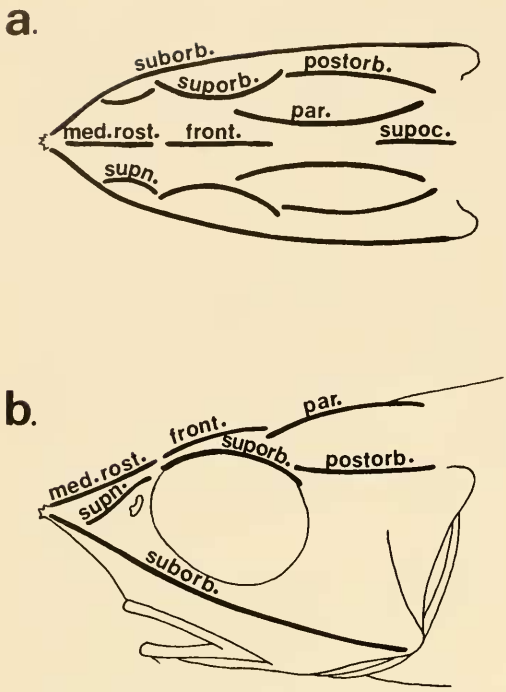

FIGURE 2. Diagrammatic dorsal (a) and lateral (b) views of head of *Coelorinchus* showing positions of head ridges. Abbreviations: front.—frontal ridge; med. rost.—median rostal ridge; par.—parietal ridge; postorb.—postorbital ridge; suborb.—suborbital ridge; supn.—supranarial ridge; supoc.—supraoccipital ridge; suporb.—supraorbital ridge.

counts of the upper limb are usually separated from those of the lower limb by a plus (+) sign. In some cases the uppermost and lowermost rakers are minute and require substantial magnification and teasing of the surrounding tissue to expose them.

Head ridges in species of *Coelorinchus* are particularly prominent compared with those found in other genera of macrourids. The ridges are sharply defined by rows of stout, spiny, deeply embedded, nonimbricate, scutelike scales. Often, the spinules on the ridge scales are imbricate, aligned in longitudinal or divergent rows, and form sharp, serrated keels or crests. Terminology for the head ridges generally follows Okamura (1970a:6–7, text-fig. 2) with some modifications. Names and diagrams of the positions of the ridges as I use them for *Coelorinchus* are shown in Figure 2. I use the term suborbital to collectively refer to Okamura's three separately defined ridges—the lateral nasal, infraorbital, and the longitudinal axis of the preopercular ridge. These three ridges in *Coelorinchus* form essentially one continuous ridge, and I have found it more convenient to refer to them here as a single unit.

In the "Materials Examined" sections, collections are listed according to geographic locality and latitude, the northernmost captures for each political entity listed first. Museum catalog numbers are followed (in parentheses) by the number of specimens and their range of head length and/or total length (in mm). A plus sign after a number indicates the specimen had a terminal portion of the tail missing (whether a "pseudocaudal" is developed or not). The geographical coordinates, the capture depths, and other pertinent capture data follow.

Genus **Coelorinchus** Giorna

Coelorinchus Giorna, 1809:177–180 (type-species *Coelorinchus La-Ville* Risso, 1810, by monotypy).

DIAGNOSIS.—Macrourine grenadiers with six branchiostegal rays. Abdominal light organ usually well developed, often with one or two large external dermal windows anterior to, and often very remote from, anus. Anus usually immediately in advance of anal fin or much closer to anal-fin origin than to pelvic bases. Second spinous ray of first dorsal fin usually smooth, rarely with a few small denticles near tip. Suborbital ridge strongly developed, usually very angular in cross section. Head ridges strong, reinforced with stout scutelike scales. Snout moderately to greatly projecting. Orbits large, elliptical, usually less than 1.5 into postorbital length of head. Body relatively shallow, belly region broad and long. Pelvic fins widely separated, consistently with 7 rays. Interopercle usually completely hidden behind preopercle.

REMARKS.—Okamura (1970a:148) gave a detailed description of the genus using additional generic characters not in the above diagnosis. A broader survey of the genus, however, will likely necessitate modification of some of his diagnostic characters.

See Marshall and Iwamoto (*in* Marshall 1973:538) for a generic synonymy. Okamura (1970a:143; 1970b) has recognized *Abyssicola* Goode and Bean, 1896, with its only species *A. macrochir* (Günther, 1877), as distinct from *Coelorinchus* based on the following features: large mouth; weak infraorbital ridge, strongly curved anteriorly; suborbital region not horizontal; head compressed; teeth in series; and anus

remote from anal fin. Stated thusly, these features do not truly reflect the very different physiognomy of *A. macrochir*, as compared with that of most species of *Coelorinchus*. In particular, the structure of the suborbital ridge, the relatively large mouth, and the dentition are quite in contrast with the same features in species of *Coelorinchus*. But the relationships of this monotypic genus are obviously with *Coelorinchus* (to which Okamura agrees), and they share so many features in common that one must wonder if subgeneric treatment of *Abyssicola*, following Gilbert and Hubbs (1920:425), might not be preferable.

Members of the genus *Coelorinchus* form a tightly knit group within the large and diverse subfamily Macrourinae. As far as known, all members of the genus are closely associated with the bottom as adults, with forays into the overlying water column probably infrequent (*C. aspercephalus* Waite, 1911, with its terete body and rounded snout, may be an exception). The general external morphology in most species of *Coelorinchus* suggests a bottom dweller. The mouth is inferior, often very small and U-shaped, the ventral aspects of the head and body are somewhat flattened, the gill openings are usually restricted ventrally, the suborbital ridge is reinforced by heavy scutelike scales, and the snout is usually pointed and spade-shaped.

An abdominal light organ is present in all species of *Coelorinchus*. It has been studied in detail by several workers but most notably by Haneda (1951), Hickling (1931), and Okamura (1970a, 1970b). The saclike organ, which houses symbiotic luminescent bacteria, is situated within the body wall in front of the anus. The lumen of the organ is connected to the rectum via a small duct through which the luminescent bacteria can presumably be ejected to the exterior. Hickling (1931) believed that the organ in *C. coelorhincus* is fully functional in the young but becomes essentially nonfunctional in older individuals. The organ has been of taxonomic use in the family Macrouridae since Gilbert and Hubbs (1916) first recognized it as being of possible luminescent function. In *Coelorinchus* it is variously developed, from a small, short structure abutting the anterior wall of the anus, to an elongated double-sacced structure with one sac located on the chest between the pelvic fins and connected by a long duct to a second slightly smaller sac in front of the anus. Separation of the five nominal subgenera of

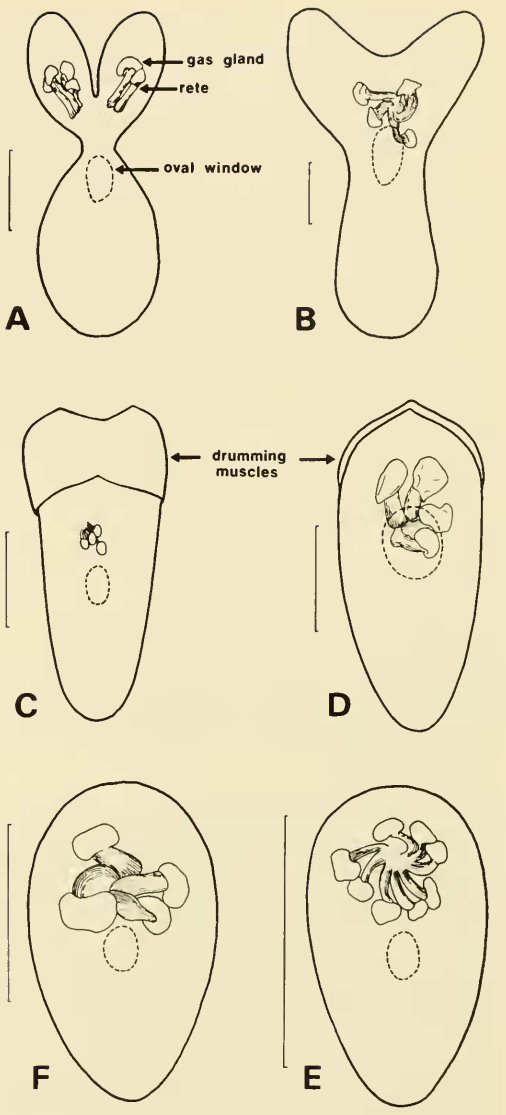

FIGURE 3. Diagrammatic illustrations of gasbladder of six species of *Coelorinchus* showing general shape, position of oval window, shape and structure of rete-gas gland complex and, in two species, position of drumming muscles: (A) *C. fasciatus*, ♀, 52 mm HL, CAS-SU 23006; (B) *C. occa*, ♀, 101 mm HL, CAS 14529; (C) *C. chilensis*, ♂, 69 mm HL, CAS uncat.; (D) *C. aconcagua*, ♀, 58 mm HL, CAS 36801; (E) *C. canus*, ♀, 34 mm HL, CAS 35914; (F) *C. scaphopsis*, ♀, 46 mm HL, CAS-SU 179. Scales represent 5 mm.

Coelorinchus is based primarily upon the relative development of the organ. The sequence from lowest to highest development is seen in the subgeneric series: *Oxygadus, Oxymacrurus, Paramacrurus, Coelorinchus, Quincuncia*.

The gas bladder of *Coelorinchus* is large and usually oval, but in a few species it is partially or completely divided into anterior and posterior chambers with the anterior chamber bilobed. *C. fasciatus* (Günther, 1878) and its closest relatives exhibit this latter condition. Species of *Coelorinchus* generally, but not invariably, have four large gas glands, each attached to a short broad rete. In *C. fasciatus* the rete-gas gland complex is usually divided into two pairs, one pair for each lobe of the anterior chamber. In nine *C. canus* (Garman, 1899) specimens I examined, the number of rete-gas gland combinations varied from 6–11; generally the higher the number, the smaller the size of each combination. Gas bladders of five eastern Pacific species and one Atlantic species of *Coelorinchus* are diagrammed in Figure 3.

Sexual dimorphism has been noted in certain species of *Coelorinchus*. Gilbert and Hubbs (1920:371) reported that the first dorsal, pectoral, and ventral fins of *C. velifer* Gilbert and Hubbs, 1920, and its allies are longer in adult males than in females or young males. Marshall (1965:313) found well-developed drumming muscles on the gas bladder in males of various species of *Coelorinchus* (and other macrourid genera) but not in the females.

The genus *Coelorinchus* is the most speciose of the approximately 25 genera of the Macrouridae. The taxon reaches its greatest diversity in the Philippines, where Gilbert and Hubbs (1920:424) reported 23 species, or 45 percent of the (then) known species of the genus. Off Japan the genus shows a lesser, but still high, diversity with 16 species (Okamura 1970a). Other major faunal areas have fewer species: Australia-New Zealand, 7; Indian Ocean, about 5; Atlantic Ocean, 7 (with 5 subspecies of *C. coelorhincus*); Hawaii, 3; eastern Pacific, 6.

The group, as a whole, is one of upper-continental-slope depths. Most species are found well above the 1000-meter isopleth, although several are known from depths to about 1500 m. Only one species, *C. labiatus* Koehler, 1896, is known from below 2000 m (2222 m in the eastern Atlantic off Azores; Grey 1956:183). Those species that are deepest living and those that live in the highest latitudes attain the largest size.

Depth or habitat preferences are seen among some species that are otherwise geographically sympatric. Thus in the western Atlantic Ocean, *Coelorinchus coelorhincus carminatus* (Goode, 1880) is often taken in trawls together with *C. caribbaeus* (Goode and Bean, 1885) and *C. occa* (Goode and Bean, 1885), but depth preferences of the three suggest a distinct partitioning of the slope bottom with *C. caribbaeus* shallowest, *C. coelorhinchus carminatus* intermediate, and *C. occa* deepest (Marshall and Iwamoto, *in* Marshall 1973).

In the eastern Pacific the species of *Coelorinchus* are among the most common fishes in upper-slope depths of about 250–1000 m. In some areas the fishes are encountered by commercial trawlers. *C. scaphopsis* (Gilbert, 1890) is frequently captured off Santa Barbara, California, by fishermen trawling for Dover sole, *Microstomus pacificus* (Lockington, 1879), and Pequeño (1971:295) reported finding *C. chilensis* (Gilbert and Thompson, 1916), in the commercial catches off San Antonio, Chile. *C. fasciatus*, though not taken in great numbers off eastern Pacific shores, is very abundant in other areas. Gilchrist (1922:59) has reported trawlers off South Africa catching several tons of the fish in a single haul.

The early life history of species of *Coelorinchus*, as with all other macrourids, is largely unknown. Sanzo (1923:125; 1931:56, pl. 5; 1933:255 et seq. and pl. 16) and Costa (1869:41, pl. 1, fig. 1) have reported eggs and larvae of *C. coelorhincus*. Gilchrist's (1905) capture of the eggs of *C. "fasciatus"* in plankton nets attached to beam trawls fished on the bottom but not in nets fished simultaneously on the surface suggests that spawning in that species takes place near the bottom. Marshall (1965:318), in providing a tentative life-history pattern for macrourids in general, suggested that after being shed and fertilized near the bottom, the eggs

> develop as they float slowly upward. The larvae hatch at levels somewhere near 200 m or continue to rise to these levels after emergence. Just before metamorphosis and afterwards the young seek deeper waters. Eventually, they reach the deep-sea floor.

Mead et al. (1964:580) added another dimension to this pattern in hypothesizing an occasional development of expatriate bathypelagic prejuveniles in abyssal species of macrourids. The relatively large size (41–44 mm TL) of the four juveniles of *C. canus* (CAS 36797) taken by midwater trawl in 0–450 m may indicate that their pelagic life was prolonged beyond that normal for the species and that they are thus expatriates.

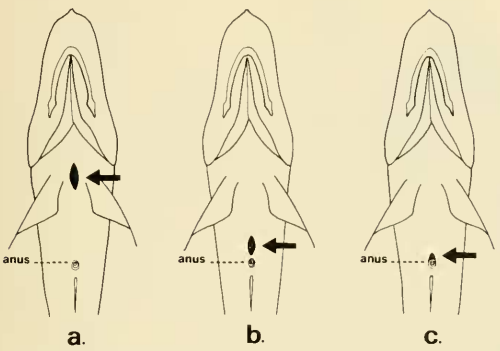

FIGURE 4. Ventral view of abdomen of species of *Coelorinchus* showing relative development and placement of naked fossa of light organ: (a) *Coelorinchus scaphopsis*; (b) *C. fasciatus*; (c) *C. aconcagua*.

KEY TO THE ADULTS OF EASTERN PACIFIC SPECIES OF *COELORINCHUS*

1a. A prominent, black naked fossa on chest far removed from anus (Fig. 4a) 2
1b. A black naked fossa on belly close before anus (Fig. 4b) or no naked fossa (Fig. 4c) 3
2a. Head covering thin, mostly transparent. Except for ridges, most of head naked or covered with thin, nonspinulated scales. Base of tongue black anteriorly ..... *C. canus* (p. 317)
2b. Head covering rather thick, opaque. Head dorsally almost completely covered with coarsely spinulated scales. Entire floor of mouth pale ..... *C. scaphopsis* (p. 313)
3a. Snout short, length much less than diameter of orbit 4
3b. Snout long, length about equal to or (usually) much greater than diameter of orbit 5
4a. A large naked fossa immediately anterior to anus (Fig. 4b). Gill-rakers 7–11 on medial (inner) side of outer arch ..... *C. fasciatus* (p. 322)
4b. No fossa on belly (Fig. 4c). Gill-rakers 11–14 on medial side of outer arch ..... *C. aconcagua* (p. 319)
5a. A stout scutelike scale at posterior end of occipital region. 7–9 (usually 7 or 8) segmented rays in first dorsal fin. Distance between first and second dorsal fins less than 2 into orbit diameter. Height of anterior rays of second dorsal less than half height of anterior anal rays (Fig. 5a) ..... *C. chilensis* (p. 332)
5b. No scutelike scales at posterior end of occipital region. 9–10 segmented rays in first dorsal fin. Distance between first and second dorsal fins more than 2 into orbit diameter. Height of anterior rays of second dorsal more than half height of anterior anal rays (Figs. 5b) ..... *C. innotabilis* (p. 329)

SPECIES DESCRIPTIONS

Coelorinchus scaphopsis (Gilbert)

(Figures 3F, 4A, 6, 7B, 8)

Macrurus (Coelorhynchus) scaphopsis Gilbert, 1890:115 (original description; holotype and many paratypes from northern Gulf of California in 265 m; ALBATROSS sta. 3015).—Brauer 1906:388 (distribution compiled).—Böhlke 1953:58 (12 syntypes in Stanford University collection listed).

Coelorhynchus (Coelorhynchus) scaphopsis: Gilbert and Hubbs 1916:144 (listed); 1920:426 (in key).

Coelorhynchus scaphopsis: Goode and Bean 1896:397 (listed).—Jordan and Evermann 1898:2590–2591 (description after Gilbert).—Jordan, Evermann, and Clark 1930:207 (listed).—Lavenberg and Fitch 1966:105 (92 specimens, northern Gulf of California).—Makushok 1967:208 (distribution compiled).—Chirichigno-F. 1968:416–417 (compared with *C. canus*); 1969:37 (listed).

Coelorinchus scaphopsis: Iwamoto and Stein 1974:50–51, figs. 1a, 2a, 3a (distinguishing features; California and Gulf of California records).

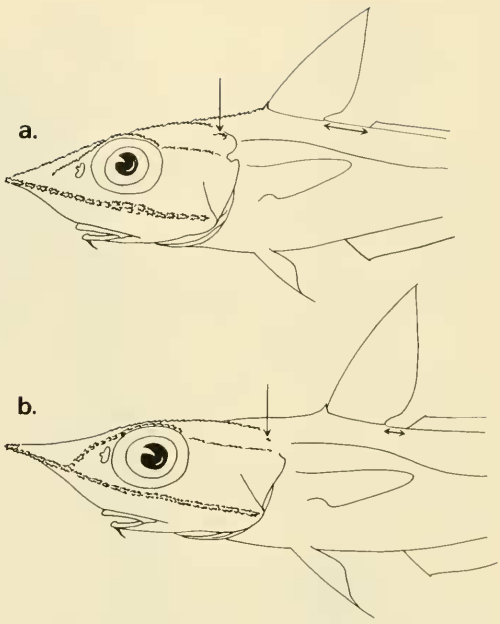

FIGURE 5. Diagram of (a) *Coelorinchus chilensis* and (b) *C. innotabilis* comparing presence or absence of stout scutelike scale at posterior end of occipital region, relative distance between first and second dorsal fins, and relative heights of second dorsal fin.

DIAGNOSIS.—A species of *Coelorinchus* with anus slightly removed by 1–3 scale rows from anal fin. Long ventral light organ with large anterior dermal window between pelvic bases. Subopercle broadly rounded posteroventrally. Body moderately deep, greatest depth 5.5–7.5 into TL. Snout relatively short and blunt, length 31–35 percent HL, about equal to or (usually) slightly less than orbit diameter. Scales with spinules arranged in subparallel rows, the middle row longest and slightly higher than other rows; rows on either side of middle row short, not extending to posterior edge of scale; scales present

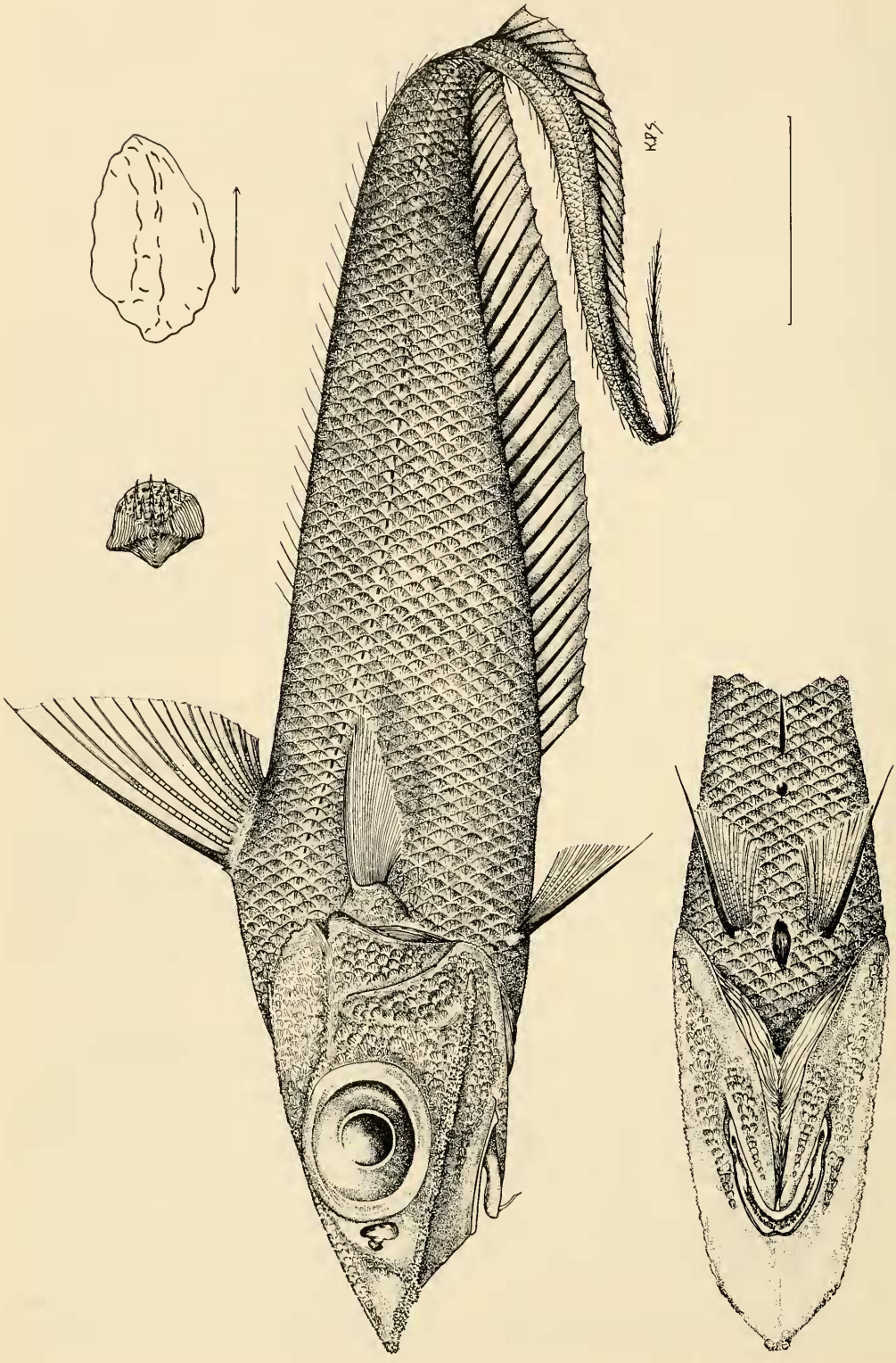

FIGURE 6. *Coelorinchus scaphopsis* (Gilbert). Lateral view drawn from 54-mm-HL specimen, CAS 14555, with additions made from specimens CAS 29296 and 27802; ventral view of head and trunk of CAS 14555; scale from area below origin of second dorsal fin of CAS 14555; right otolith from 66-mm-HL specimen from CAS 27802.

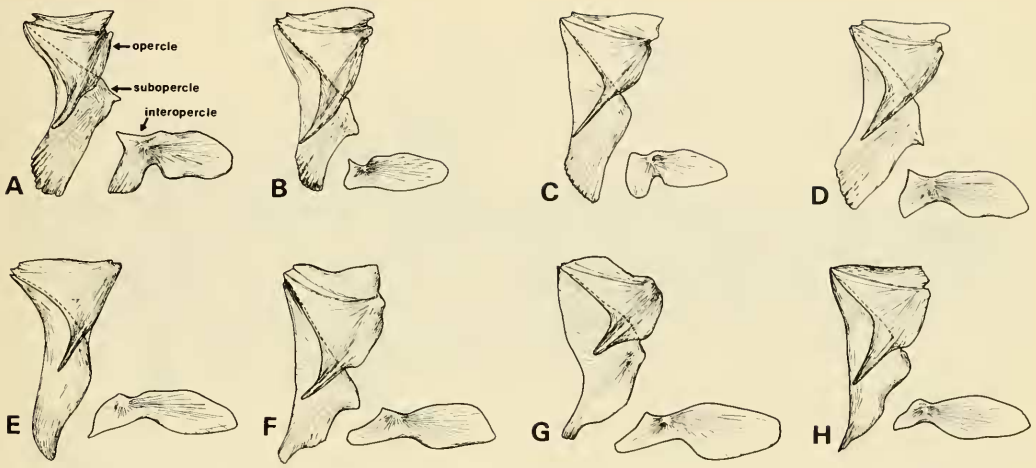

FIGURE 7. Right opercle, subopercle and interopercle bones of eight species of *Coelorinchus*. (A) *C. caribbaeus*; (B) *C. scaphopsis*; (C) *C. canus*; (D) *C. coelorhincus carminatus*; (E) *C. aconcagua*; (F) *C. fasciatus*; (G) *C. innotabilis*; (H) *C. chilensis*.

on lower jaw and underside of head. Mouth small, upper jaw 28–32 percent HL. Height first dorsal fin about equal to or somewhat longer than postrostral length of head.

DESCRIPTION.—General features as in Figure 6. Greatest depth of body about 5.5–7.5 into TL. Head robust, width over opercles about equal to greatest head depth. Trunk and tail moderately laterally compressed. Anus slightly removed from anal fin by 1–3 scale rows. Head ridges stout but not particularly conspicuous; suborbital ridge forms an obtuse angle between dorsal and ventral head surfaces. Median and lateral processes of nasal bones incomplete; anterolateral margins of snout thus not strongly supported by bone. A weak supraoccipital ridge formed by a narrow file of 2–4 scales, each with high median spinule ridge. Postorbital and parietal ridges narrow, fairly sharp. Interopercle pointed, without a deep ventral emargination, completely hidden beneath preopercle; subopercle rounded posteroventrally, without a produced tip (Fig. 7B). Chin barbel short, thick at base but tapering rapidly to filamentous tip.

Scales of body (Fig. 6) moderate in size, rather coarsely covered with subparallel rows of sharp, reclined, imbricate spinules; middle spinule row longest and highest; 2–4 rows laterally on each side of middle row; rows adjacent to middle row often incomplete, not extending to edge of scale. Head scales (except those forming ridges) covered with small spinules in divergent rows. Head surfaces below suborbital ridge covered with small loose scales; scaled area extending anteriad as a wedge from preopercle to below anterior margin of orbit. Rami of lower jaws with a narrow file of small scales. Gill membranes, ventral surfaces of snout, lunate areas dorsally behind anterolateral margins of snout, and area around nostrils naked. Terminal snout scute broad and blunt.

Abdominal light organ well developed. A large anterior dermal window (length more than half diameter of pupil) between and slightly anterior to pelvic-fin bases.

Gill membranes broadly connected to isthmus with a very narrow free fold posteriorly. Slits between gill arches moderately wide (for genus); outer slit about ⅔ orbit diameter. Uppermost (epibranchial) gill-rakers padlike, triangular; lowermost raker often triangular, much smaller than, and not in alignment with, other rakers; middle rakers on each arch more tubercular with 1–3 sharp, conical, recurved spinules at tip.

Fins small to moderate in size. Second spinous ray of first dorsal fin scarcely, if at all, extending beyond branched rays; height of first dorsal fin usually less than postrostral length of head. Second dorsal fin separated by a moderate gap from first dorsal fin and weakly developed throughout. Pectoral fins extend to, or slightly beyond, vertical through anal-fin origin. Pelvic fins in larger specimens (more than about 60 mm HL) fall short of anal-fin origin, but in

smaller specimens, outer pelvic ray extends beyond that origin. Outer pelvic ray somewhat thicker than other rays of fin.

Intestinal coiling pattern about like that illustrated by Okamura (1970b: fig. 65B) for *Coelorinchus asteroides* Okamura, 1963; posterior loop, however, extends anteriad slightly farther than shown. Pyloric caeca unbranched, slender, relatively long (length about ⅔ orbit diameter); 15, 20, and 26 in three specimens. Ovaries large in specimens (CAS 29296) taken in late October from off Santa Barbara County, California; individual eggs well formed but small, largest ones slightly more than 1.0 mm in diameter.

Coloration in alcohol generally swarthy with bluish to purplish tinge over abdomen, gill covers, and gill membranes. A large black lunate area behind pectoral-fin bases. Median and pectoral fins generally dusky; pelvic fins blackish, but outer ray of fin generally paler. Oral cavity completely pallid. Gill cavity generally black except for pale inner region of opercular wall. Gill arches somewhat dusky, but rakers and filaments pallid. Peritoneal lining moderately to heavily peppered with large melanophores; stomach blackish.

Measurements.—Total length 163+ to 340 mm, head length 40–80 mm. The following in percent of head length [range ($\bar{x}$; n; SD)]: snout length 30.5–35.4 (32.33; 19; 1.373); preoral length 24.9–32.7 (29.87; 19; 1.776); internasal width 19.0–22.8 (21.48; 19; 1.182); orbit diameter 31.1–36.5 (33.91; 19; 1.545); interorbital width 21.5–25.2 (22.98; 19; 1.108); postorbital length 29.6–33.5 (31.34; 17; 1.331); orbit to angle preopercle 33.1–37.2 (35.29; 19; 1.249); suborbital width 12.2–14.5 (13.21; 19; 0.568); upper jaw length 27.8–32.1 (29.66; 19; 1.224); barbel length 6.5–10.6 (8.61; 19; 0.852); outer gill-slit length 16.7–21.1 (19.53; 18; 1.079); preanal length 132.4–163.8 (143.6; 19; 10.490); outer pelvic to anal 33.9–58.9 (43.58; 18; 6.705); isthmus to anal 57.9–84.9 (68.12; 17; 7.294); greatest body depth 54.8–72.1 (62.58; 19; 5.147); 1D.–2D. interspace 21.4–41.7 (33.44; 19; 4.969); 1D. height 55.8–71.7 (62.13; 18; 4.544); pectoral fin length 43.0–52.5 (46.59; 19; 2.454); pelvic fin length 32.1–49.6 (38.67; 18; 4.972).

Counts.—1D. II, 7–9 (usually 8); pect. i17–i19 (rarely i16); inner (medial) gill-rakers, first arch 1–2 + 8–10; second arch 1–2 + 7–10; scales below 1D. 5–7; below 2D. 4–6½; below mid-1D. 3½–4½; over distance equal to predorsal length 27–33 ($\bar{x}$ = 29.81; n = 16); pyloric caeca 15–26 (n = 3).

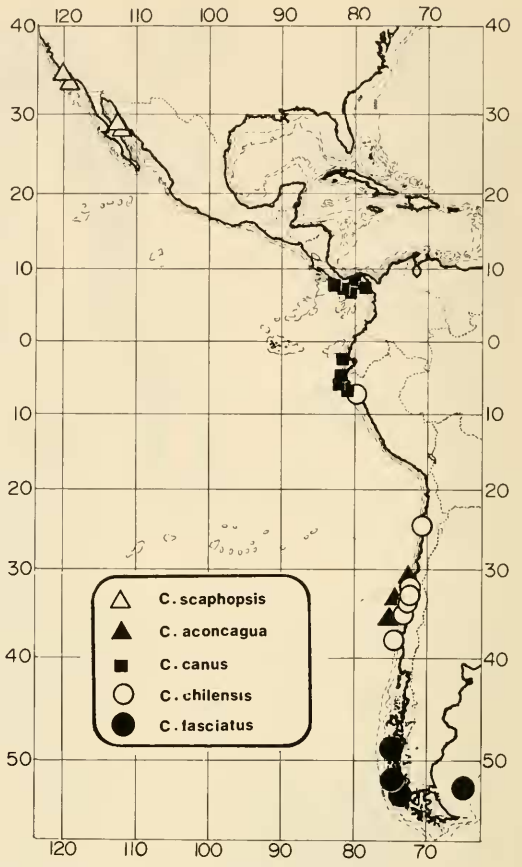

Figure 8. Map showing eastern Pacific distributions of five species of the genus *Coelorinchus*.

Comparisons.—Of the eastern Pacific species, *C. scaphopsis* is most closely related to *C. canus*, but the two are readily distinguished by the absence in *scaphopsis* of a deep notch on the ventral margin of the interopercle (Fig. 7b) and their different scale spinulation. The former feature and the general physiognomy of the head and body suggest a closer relationship of *scaphopsis* to *C. coelorhincus* than to any other member of the genus. Scale spinules in *C. coelorhincus* are, however, in a more-or-less quincunx pattern in contrast to the distinct rows in *C. scaphopsis*. Although Gilbert and Hubbs (1920:426) placed *C. scaphopsis* close to *C. patagoniae* Gilbert and Thompson, 1916 (=*C. fasciatus*), the significant differences between the two in head squamation and light-organ structure suggest a more distant relationship.

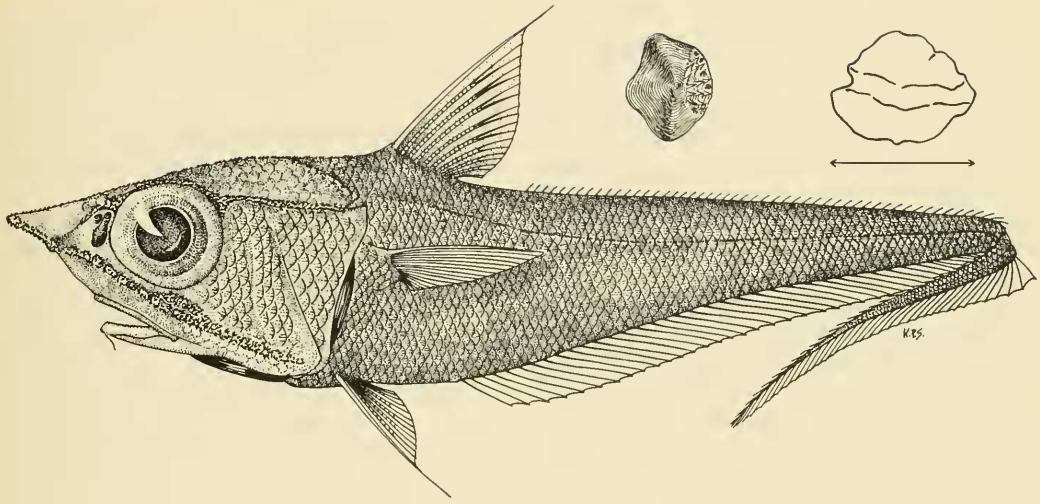

FIGURE 9. *Coelorinchus canus* (Garman). Redrawn and slightly modified illustration from Garman (1899:pl. 84, fig. 1); right otolith from a specimen 38 mm in head length (scale line below otolith represents 5 mm); illustration of a scale taken from below origin of second dorsal fin of a specimen 35 mm in head length.

DISTRIBUTION.—*C. scaphopsis* is known only from the northern Gulf of California and off the coast of southern California (Fig. 8). Brewer (1973:40) reported the species from three captures south of the Gulf of California, but examination of his specimens (LACM 11748, 13771, 13778) revealed that they are juveniles of *Nezumia liolepis* (Gilbert, 1890). *C. scaphopsis* is taken occasionally by commercial trawlers out of Santa Barbara, California (Rich Lee and Joe Copp, personal communication), and Lavenberg and Fitch (1966:105) stated that it "appears to be the commonest rattail in the upper Gulf." Despite its apparent abundance in these two areas, the authenticated distributional range of *C. scaphopsis* is very limited, perhaps because of inadequate sampling. It should be expected in outer slope waters of Baja California and along most of the mainland coast of Mexico.

MATERIAL EXAMINED (more than 100 specimens, 8 localities). CALIFORNIA:—SIO 61–194 (1, 80 mm HL, 340 mm TL), Santa Barbara Co., off Pt. Conception, 265–274 m.—CAS 29296 (4, 65–72 HL, +260–340 TL), Santa Barbara Co., off Gaviota, 287 m, otter trawl, 23 Oct. 1968.—CAS 29298 (1, 67 HL, 280 TL), Santa Barbara Co., off Naples, 296 m, otter trawl, 18 Nov. 1968.—SIO 67–267 (1, 59 HL, 230 TL), Santa Cruz Is., Pelican Bay, 247 m.—CAS 14555 (1, 54 HL, 245 TL), Santa Cruz Is., Pelican Bay, 202–274 m.—CAS 27802 (1, 64 HL, 282 TL), W side Santa Catalina Is., 33°25.3′ N, 118°32.5W, 183 m, 7 June 1971. GULF OF CALIFORNIA:—SIO 68–94 (>100 spec.), 29°19.9′N, 113°10.4′W, bottom trawl.—USNM 44272 (holotype, 61 HL, 250 TL) and CAS-SU 179 (11 paratypes, 41–59 HL, 240+–260 TL), 20°19′N, 112°50′W, 265 m, beam trawl, ALBATROSS sta. 3015, 24 March 1889.—SIO 73–3 (1, 24 HL, 110 TL), 28°25′N, 112°22′W, bottom trawl, sta. AH 7206, 12 Nov. 1972.

Coelorinchus canus (Garman)

(Figure 3E, 7C, 8, 9)

Macrurus canus Garman, 1899:217–218, pl. 49, fig. 2, pl. 84, fig. 1, 2 (original description; illustration; many specimens off Panama, ALBATROSS sta. 3355 in 333 m, sta. 3389 in 384 m, sta. 3391 in 280 m).—Chirichigno-F. 1968: 415–418, fig. 12 (description; illustration; 11 specimens, 2 localities off northern Peru, 4°48′N, 81°17′W); 1969: 37 (listed from Ecuador and possibly Peru); 1974: 315, fig. 621 (in key; illustration).

Macrurus (Coelorhynchus) canus: Brauer 1906: 388 (distribution compiled).

Coelorhynchus (Coelorhynchus) canus: Gilbert and Hubbs 1916:144 (listed); 1920:426 (in key).

Coelorhynchus canus: Makushok 1967: 208, Table 18 (compiled distribution; implies range of *C. canus* extends to Gulf of California but no documentation given).—Marshall and Iwamoto *in* Marshall 1973:540 (listed).—Parin and Makushok 1973:179 (1 specimen off Ecuador, 228–275 m).

DIAGNOSIS.—A species of *Coelorinchus* with a large dermal window of the light organ situated between and slightly anterior to bases of pelvic fins. Subopercle broadly rounded posteroventrally; interopercle with a deep emargination. Height first dorsal fin usually less than postrostral length of head. Snout of moderate length, 29–37 percent HL, about equal to orbit diameter. Body scales with small, slender, conical spinules aligned in slightly divergent rows; median row not enlarged. Scales on head thin, de-

ciduous, often without spinules. Loose scales present on rami of lower jaws and below suborbital region.

DESCRIPTION.—Head and body moderately compressed, greatest width of head 1.2–1.5 into its greatest depth. Head covering thin, transparent. Bones of head rather thin, mostly transparent or translucent. Head ridges low, not particularly stout or spiny. Supraoccipital crest high, but without a row of scutelike scales. Terminal snout scute blunt, wide, more spiny ventrally than dorsally. Mouth moderately broad, not notably restricted laterally. Subopercle broadly rounded posteroventrally, without a produced tip; interopercle with deep cleft in ventral margin (Fig. 7C); posteroventral tip barely exposed beyond ventral margin of preopercle.

All fins except second dorsal fin moderately developed. Outer pelvic ray slightly prolonged, extending well past anal-fin origin. Other fins without produced rays. Second dorsal fin rudimentary over most of length.

Abdominal light organ well developed. Large dermal window between and slightly anterior to bases of pelvic fins.

Alimentary canal simple; intestine S-shaped or with a short posterior loop before entering rectum. Pyloric caeca short, unbranched, 10–14. Anus immediately in advance of anal fin, but sometimes with one or two scales separating the two.

Head scales, except on ridges, thin and often without spinules. Specimens smaller than about 40 mm HL have broader naked areas and thinner, less spinulated scales on head. Dorsal and ventral surfaces of snout mostly naked. Area below ventral surfaces of head scaled from below midorbit posteriad to hind margin of preopercle. A row of narrow, spinuleless scales generally present on rami of lower jaw in larger specimens. Body uniformly covered with moderate-size spinulated scales. On larger scales below dorsal fins of 50-mm-HL specimen, scales have 6–7 slightly divergent rows of slender, conical spinules with up to 8 spinules in median row, fewer in lateral rows. Scales on pectoral-fin base and shoulder girdle small and spinuleless.

Gill-rakers tubercular, usually two or three epibranchial rakers, 7–9 ceratobranchial and hypobranchial rakers. Often one or more rakers at either end of gill arch very small and platelike. Other rakers with one or few short spinules.

Gas bladder with 6–11 short, flattened retia, each connected to a round to kidney-shaped gas gland (Fig. 3E). Generally the fewer the number, the larger each rete-gas gland complex. All specimens in which sex could be macroscopically determined were females; no drumming muscles were present in these.

Dentition in both upper and lower jaws consists of small, conical teeth in narrow tapering bands. No series of enlarged teeth.

Coloration in alcohol. Trunk and tail somewhat flesh colored to swarthy, darker dorsally, violet over abdomen, blackish over chest. Gill cover and ventral surface of head somewhat silvery in very fresh specimens, but silver color lost in long-preserved specimens. Leading edge of snout, medial side of pectoral-fin base, margin of the first dorsal-fin base black. Rami of lower jaw heavily punctate; ventral surface of snout, ventral edge of suborbital region, and preopercle variously punctate. Large melanophores widely scattered over most other parts of head covering. Outer edges of gill cavity black; inner surface pale with scattered melanophores. Outer edge of preopercle with heavy punctation. Oral cavity mostly pale but blackish along base of tongue. Abdominal cavity pale but peppered with large melanophores.

MEASUREMENTS.—Total length 106+ to 234 mm; head length 30.1–55.3 mm. The following in percent of head length [range ($\bar{x}$; n; SD)]: snout length 29.0–37.3 (33.78; 52; 1.602); preoral length 27.7–36.0 (31.19; 48; 1.557); internasal width 19.4–27.2 (22.12; 50; 1.520); orbit diameter 29.7–34.8 (32.05; 49; 1.218); interorbital width 22.9–33.0 (27.64; 48; 1.881); postorbital length 29.5–35.8 (33.32; 50; 1.377); orbit to angle preopercle 35.1–40.5 (36.79; 51; 5.324); suborbital width 9.3–13.3 (10.89; 49; 0.831); upper jaw length 24.4–30.9 (27.28; 50; 1.408); barbel length 3.2–8.8 (5.99; 49; 1.180); outer gill-slit length 17.0–21.0 (18.94; 51; 1.009); preanal length 109.2–133.8 (124.07; 48; 5.208); outer pelvic to anal 21.0–38.0 (30.36; 49; 3.336); isthmus to anal 38.8–61.2 (52.55; 47; 4.051); greatest body depth 53.0–71.6 (61.47; 48; 4.145); 1D.–2D. interspace 19.3–38.2 (27.45; 51; 4.649); 1D. height 51.1–71.3 (61.52; 43; 5.326); pectoral fin length 42.6–60.2 (51.65; 48; 4.594); pelvic fin length 36.4–48.8 (42.10; 47; 3.731).

COUNTS.—1D. II, 8–10; pect. 18–24; inner (medial) gill-rakers, first arch 1–4 + 8–11 (usually 2 + 9–10); second arch 1–3 + 8–11 (usually

2–3 + 9–10); scales over distance equal to predorsal length 32–36; pyloric caeca 10–14 (n = 15).

Comparisons.—*C. canus* appears to be most closely related to *C. caribbaeus* from the western Atlantic, sharing with that species a similar head physiognomy, large dermal window on chest, thin head covering, deeply emarginate interopercle, rounded posteroventral edge of subopercle, and rather weakly armed head ridges. The two species are readily distinguishable by differences in scale spinulation (spinules more numerous and not in well-defined rows in *caribbaeus*), orbit diameter (27–31, usually 27–29 percent HL in *caribbaeus*, 30–35 in *canus*), barbel length (8–11 percent HL in *caribbaeus*, 3–9 in *canus*), and lining of oral cavity (completely pallid in *caribbaeus*, blackish at base of tongue in *canus*). Of the eastern Pacific species, *C. canus* is closest to *C. scaphopsis*; the two are compared in the description of the latter.

Distribution.—The species is known only from tropical waters of the eastern Pacific between northern Peru (6°20′S) and Costa Rica (to about latitude 9°N) (Fig. 8) in depths ranging 70–360 m. The species might be expected to range farther northward to the offings of the mouth of the Gulf of California.

Biological Notes.—*C. canus* is apparently bathypelagic during its early life, judging from four juveniles (CAS 36797) taken by midwater trawl in 0–450 m off the coast of Ecuador. This would agree with Marshall's (1965) ideas regarding the early life history of slope-dwelling macrourids.

Examination of the stomach contents of several mature individuals revealed a preponderance of copepods and other small crustaceans in their diets and the absence of strictly bottom-dwelling invertebrates.

Material Examined (153 specimens, 22 localities). COSTA RICA: CAS 35910–35920, collected by F. H. Berry, Dec. 1973 and Mar. 1974, in 192–296 m, 36 specimens (33–43 mm HL, 111–164 mm TL). PANAMA: GCRL 14250–14256, Canopus collections, 1973–1974, in 108–293 m, 15 specimens (30–49 HL, 85+ – 198 TL). ECUADOR: CAS 35921 (1, 54 HL, 213 TL), Gulf of Guayaquil, 02°14′S, 81°11.5′W, 120–140 m, Te Vega cr. 19, sta. 145, 31 Aug. 1968.—CAS 36797 (4 juv., 41–44 TL), 03°41′–36′S, 81°36′–20′W, 0–450 m, midwater trawl, Anton Bruun cr. 16, sta. 623A, 30 May 1966.—CAS 35925 (11, 37+ – 48 HL, 166–199 TL), 03°50′S, 81°08′W, 300–360 m, 72-ft otter trawl, Anton Bruun cr. 18B, sta. 767 (LWK 66–116). PERU: CAS 35924 (6, 31–43 HL, 120+ – 168+ TL), 04°57′S, 81°24′W, 118–133 m, otter trawl, Anton Bruun cr. 16, sta. 625A, 2 June 1966.—CAS 36802 (1, 42.4 HL, 192 TL), 04°59′S, 81°27′W, 365–457 m, otter trawl, Anton Bruun cr. 16, sta. 626B, 3 June 1966.—CAS 35923 (67, 25–55 HL, 105–234 TL), 05°02′S, 81°24′W, 192–311 m, otter trawl, Anton Bruun cr. 16, sta. 627A, 3 June 1966.—CAS 35922 (10, 21.4–38 HL, 102–159 TL), 06°20′S, 81°01′W, 146 m, otter trawl, Anton Bruun cr. 16, sta. 633A, 4 June 1966.

Coelorinchus aconcagua new species

(Figures 3D, 7E, 8, 10)

Coelorhynchus patagoniae: Pequeño, 1971:283–386, figs. 8–10 (not of Gilbert and Thompson, 1916) (description and figures after Gilbert and Thompson, *in* Thompson 1916; 89 specimens, Pacific coast Chile, between 30°06′01″S and 41°43′05″S, 175–428 m).

Diagnosis.—A *Coelorinchus* with a small ventral light organ (length less than half pupil diameter in adults) situated immediately before anus and without an external naked fossa. Subopercle with a blunt, ventrally pointed tip. Height first dorsal fin usually slightly less than postrostral length of head. Snout short, 24.2–30.3 percent HL, length much less than orbit diameter, which is 37.5–43.5 percent HL. Mouth relatively large, upper jaw 29–36 percent HL. Ventral surfaces of head naked; head ridges all relatively low and narrow. Most body scales with numerous low, parallel rows of short spinules; exposed field of scales often with broad spinuleless margins. Gill-rakers numerous, 11–14 in inner series of first (outer) arch.

Description of Holotype (comments on paratypes in parentheses).—General shape as in Figure 10. Head large, about five into TL, slightly compressed laterally, greatest width about 1.3 (1.2–1.5) into greatest depth. Head covering relatively thin, translucent in most areas. Supraoccipital crest prominent, forming a low hump in dorsal profile. Trunk moderately compressed, greatest width over pectoral bases about 1.5 (1.4–1.8) into greatest body depth. Orbits huge, forming deep concavities in roof of skull. Mouth relatively wide and lateral for a *Coelorinchus* and little restricted laterally; upper jaw extends posteriad to below hind third of orbits. Vertical and horizontal margins of preopercle form broadly acute angle posteroventrally, partially covering subopercle, completely hiding interopercle; the last two bones shaped as in Figure 7E. Ridges of head low and narrow; terminal and lateral snout scutes weak. Suborbital ridge relatively broad behind orbits but narrow anteriorly and slightly discontinuous below nostrils; not supported by bone across anterolateral

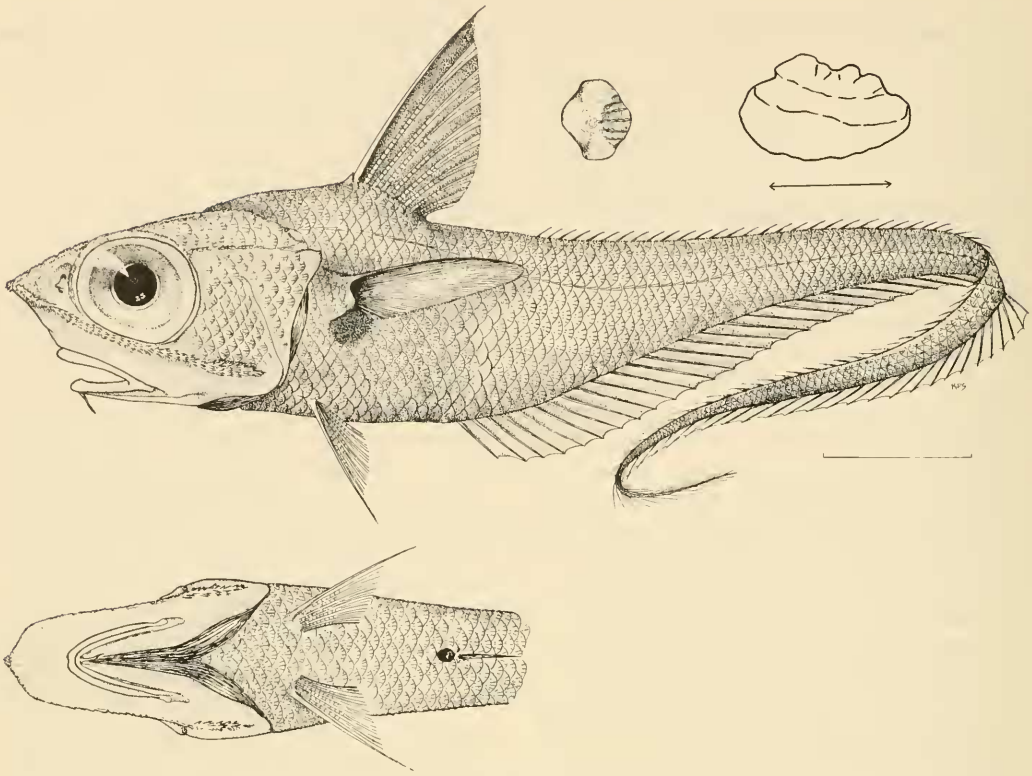

FIGURE 10. *Coelorinchus aconcagua* Iwamoto, new species. Lateral view, ventral view of head and trunk, and scale from above lateral line below interspace between first and second dorsal fins of holotype, CAS 36779, taken off Chile in 240–260 m. Otolith from right side of a paratype, CAS 36800 (56 mm HL). Scale line below otolith represents 5 mm; scale line below tail of holotype represents 25 mm.

margins. Opercular openings rather wide; branchiostegal membranes moderately restricted, with a narrow posterior free fold across isthmus. Gill filaments long; gill-rakers tubercular with small, fine teeth.

Premaxillary and dentary dentition consist of very small, fine teeth in moderately wide bands which extend, in both jaws, to posterior angles of mouth.

Scales relatively deciduous, those on body lost. (In larger paratypes, exposed fields of body scales with numerous parallel rows of small, short spinules, 7–12 rows on largest scales below dorsal-fin interspace; broad margins without spinules on exposed fields in most body scales. Median row of spinules not enlarged except on some head scales. Scales on head and chest generally with somewhat divergent spinule rows; those on chest somewhat coarser than those on trunk and tail, and more densely packed.) Ventral surfaces of head below suborbital ridge entirely naked. Large areas around nostrils and on dorsal surface of snout naked. In the holotype (as in most specimens), no scales flank the median rostral ridge (in some paratypes, a row of thin, unarmed scales flank each side of that ridge).

First dorsal and pectoral fins large, but neither longer than postrostral length of head. First spinous ray of dorsal fin thornlike; second spinous ray long but scarcely, if at all, produced beyond adjacent branched rays. (A few small, low spinules near tip on leading edge of second spinous ray in some paratypes.) Second dorsal fin low, following rather close behind first dorsal fin, poorly developed over most of length, much less developed than anal fin.

Coloration in alcohol brownish or swarthy over head; trunk bluish to violet; tail brownish with violet tinge. All fins dusky to blackish. Uppermost edge of pectoral fin and membrane between second spinous and first branched dorsal rays black. A prominent blackish area behind

pectoral bases. Gill membranes, lips, and chin barbel blackish. Oral cavity completely pallid; branchial cavity black on medial wall and outer margin of lateral wall but pallid on inner portion of lateral wall; peritoneal lining blackish but peppered with small melanophores. Gill arches and rakers blackish, but filaments pallid. The following information from paratypes: Gas bladder well developed, with four large gas glands, each connected to a short, broad rete (Fig. 3D). In a 52-mm-HL female, anterior bladder wall has a thin tough membrane with a slender bundle of muscles on each side. A 59-mm-HL male has broad sheets of muscles covering anterior end of bladder.

Intestinal coiling relatively simple, about like that illustrated by Okamura (1970b: fig. 64B) for *C. hubbsi* Matsubara, 1936. Pyloric caeca slender, unbranched, lengths about equal to pupil diameter; 16, 18, and 20 in three specimens. Ten females examined had large ovaries containing distinct eggs in various stages of development; largest eggs more than 1.0 mm in diameter.

Light organ in 59-mm-HL paratype small, black, flattened, spatulate, lying on epidermis within abdominal body wall between abdominal muscles, projecting anteriad from base of rectum, almost reaching pelvic girdle; externally apparent only as a blackish area anterior to anus; length (7.5 mm) about ⅔ of pupil diameter.

Measurements.—Total length 78+ to 345 mm, head length 19–74 mm. The following in percent of head length [range ($\bar{x}$; n; SD)]: snout length 24.2–30.3 (26.47; 34; 1.584); preoral length 22.8–28.1 (24.19; 34; 1.437); internasal width 20.4–25.0 (22.70; 30; 1.162); orbit diameter 37.4–43.5 (40.39; 34; 1.502); interorbital width 17.7–23.2 (19.62; 32; 1.356); postorbital length 29.0–34.7 (31.73; 34; 1.543); orbit to angle preopercle 32.9–36.7 (34.41; 34; 1.015); suborbital width 9.0–12.4 (10.20; 33; 0.691); upper jaw length 29.2–35.6 (31.68; 33; 1.316); barbel length 6.2–10.8 (8.56; 32; 1.102); outer gill-slit length 16.6–23.1 (19.93; 33; 1.431); preanal length 115.5–139.0 (127.39; 34; 5.722); outer pelvic to anal 22.5–40.7 (29.86; 34; 4.128); isthmus to anal 50.4–74.6 (61.09; 34; 6.113); greatest body depth 51.8–70.6 (61.83; 30; 5.086); 1D.–2D. interspace 20.0–46.3 (33.12; 34; 6.240); 1D. height 55.4–72.9 (64.03; 24; 4.850); pectoral fin length 51.9–66.3 (60.35; 33; 3.246); pelvic fin length 35.8–70.5 (45.34; 34; 8.288).

Counts.—1D. II, 9–10 (rarely 11); pect. i16–i20 (usually i17–i19); gill-rakers, first arch 2–3 + 9–12; second arch 1–3 + 8–10; scales below 1D. 5½–7; below 2D. 4½–7; below mid–1D. 3½–4½; over distance equal to predorsal length 31–36; pyloric caeca 16–20 (3 specimens).

Comparisons.—In the eastern Pacific the new species is likely to be confused only with *C. fasciatus* with which it shares a short snout, huge orbit, naked ventral head surface, and relatively low head ridges. The two are easily differentiated by the presence in *fasciatus* of fewer gill-rakers (7–9 on first arch vs. 11–14), wider suborbital space (15–19 percent of head length vs. 9–12), and large naked fossa anterior to anus (compared with none in *aconcagua*).

Coelorinchus aconcagua shares many features with *C. oliverianus* Phillipps, 1927, from New Zealand waters. The two species have a similar physiognomy, huge orbits, short snout, thin head covering, relatively large mouth, wide gill openings, relatively numerous gill-rakers, and relatively weak and narrow suborbital and other head ridges. The species are readily distinguished, however, by the presence in *C. oliverianus* of a prominent oval naked fossa between the pelvic-fin bases (thus suggesting a distant relationship), coarser body squamation in *oliverianus*, and a number of morphometric features.

Distribution.—*Coelorinchus aconcagua* is known within a narrow belt bounded by latitudes 30°06′01″S and 41°43′05″S at depths ranging 175–428 m off the Pacific coast of Chile. Its distribution lies somewhat to the north of that of *C. fasciatus*, but the two distributions apparently overlap at the 41st parallel. Pequeño (1971:275–276) listed four captures (presumably) of this species and three of *C. fasciatus* at that latitude; the two species were taken together at two of these localities.

Remarks.—I have examined five specimens reported by Pequeño (1971:283) as *C. patagoniae*—four of these were conspecific with the new species (one small individual, no. P.5.423, was a *C. fasciatus*), and there is little doubt that most others he reported under that name are *aconcagua*. It is a peculiar coincidence that Gilbert and Thompson (1916) should describe a new *Coelorinchus* from a single immature specimen of *C. fasciatus*, when an undescribed species was yet to be found in the same area with characters so similar to *fasciatus* that it was later to be confused with that species.

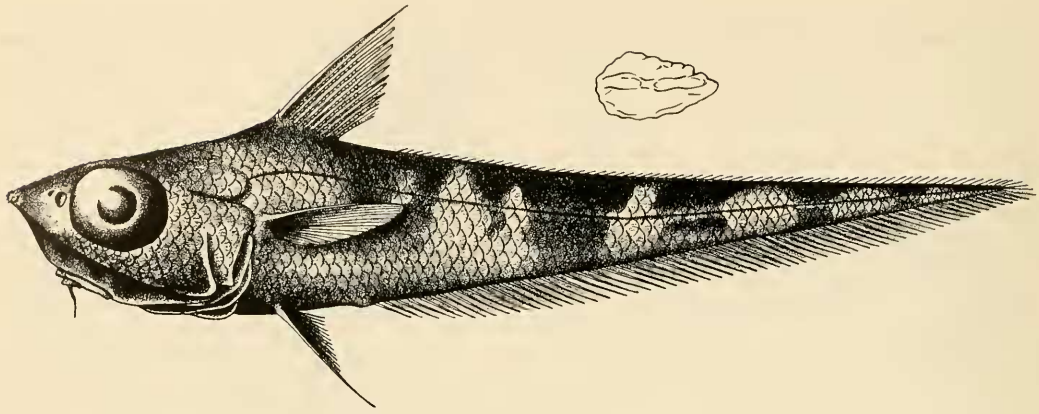

FIGURE 11. *Coelorinchus fasciatus* (Günther). Drawing modified from Günther (1887:pl. 28, fig. A) of specimen taken from east coast of southern extremity of South America, in 256 m, CHALLENGER sta. 309A. Right otolith from 57-mm-HL specimen (CAS 14528).

ETYMOLOGY.—The specific name is taken from the name of the highest peak of the western hemisphere, Aconcagua, beneath the shadows of which the holotype was captured. The name is to be treated as a noun in apposition.

MATERIAL EXAMINED (97 specimens, 10 localities, all from Chile). *Holotype*:—CAS 36799 (56 mm HL, 269 mm TL), 33°22′S, 71°53′W, 240–260 m, shrimp trawl, ANTON BRUUN cr. 18A, sta. VDM–4 (field no. LWK 66–18), 1 Aug. 1966. *Paratypes*:—MNHN, Santiago P.5.463 (1, 69 HL, 296+ TL), 30°06′01″S, 71°30′06″W, 370 m, CARLOS DARWIN, 27 Apr. 1963.—LACM 10455–3 (6, 33–48 HL, 150–219 TL), off Valparaiso, 201–119 m, July 1963.—SIO 65–675 (40, 21–68 HL, 113–305 TL), about 18 miles (29 km) off Valparaiso Harbor, 22–23 Dec. 1965.—CAS 36801 (19, 40–74 HL, 192–320 TL), IMARPE uncat. (2, 46–54 HL, 215–268 TL), 33°22′S, 71°54′W, 260–280 m, shrimp trawl, ANTON BRUUN cr. 18A, sta. 656–0 (field no. LWK 66–16), 31 July 1966.—CAS 36800 (17, 19–72 HL, 78+ –345 TL), USNM 216705 (5, 40–65 HL, 200–301 TL) and BMNH 1977.2.4.1–2 (2, 55–61 HL, 230+ – 301 TL), 35°26′S, 73°01′W, 290–450 m, shrimp trawl, ANTON BRUNN cr. 18A, sta. 697 (field no. LWK 66–39), 9 Aug. 1966.—MNHN, Santiago P.5.393 (1, 74 HL, 320+ TL), 36° 04′09″S, 73°14′07″W, 340 m, 27 Feb. 1965.—MNHN, Santiago P.5.397 (1, 62 HL, 307+ TL) 39°23′S, 73°50′W, 175 m.—MNHN, Santiago P.5.408 (1, 67 HL, 390 TL), 41°11′S, 74° 12′W, 222 m, 23 Apr. 1966.—MNHN, Santiago P.5.419 (1, 64 HL, 250+ TL), 41°41′04″S, 74°40′05″W, 250 m, 24 Apr. 1966.

Coelorinchus fasciatus (Günther, 1878)

(Figures 3A, 7F, 8, 11, 12, 13, 14, 15, 16, 17)

Macrurus fasciatus Günther, 1878: 24 (original description; east coast southern tip South America, CHALLENGER sta. 305, 309, 311, 73–448 m; erroneously stated as from west coast).—Gilchrist 1921:173–174 (eggs from South African specimens).

Macrurus (Coelorhynchus) fasciatus: Günther 1887:129–130, pl. 28, fig. A (redescription of types, CHALLENGER stations corrected to 305A, 309, 309A, 311, 73–448 m; 8 specimens illustration).—Brauer 1906:259 (descr.; 16 spec., off South Africa).

Coelorhynchus fasciatus: Goode and Bean 1896:402 (description after Günther).—Garman 1899:397 (listed).—McCulloch 1907:348 (1 specimen; 56.3 km E of Sydney, Australia; 1463 m).—Gilbert and Thompson, *in* Thompson 1916:473 (numerous specimens off SW tip Chile: ALBATROSS sta. 2783 in 223 m, sta. 278 in 355 m).—McCulloch 1919:32, pl. 11, fig. 115b (compiled).—Waite 1927:229 (listed); 1928:5 (listed).—Hart 1946:280 (140 specimens from Patagonian Shelf off Argentina).—Poll 1953:228–229, fig. 94 (32 specimens, off SW Africa, 220 m; description, illustration).—Mann 1954:186 (listed from Chile).—Scott 1970:43 (in key).—Marshall and Iwamoto, *in* Marshall 1973:539 (in key).

Coelorhynchus (Paramacrurus) fasciatus: Gilbert and Hubbs 1916:144 (name only); 1920:426 (in key).—Barnard 1925:340–341 (description; South Africa distributions, 163–457 m).—McCulloch 1926:177–178 (60 specimens; Bass Strait, Tasmania, Great Australian Bight, 268–823 m).

Coelorhynchus patagoniae Gilbert and Thompson, *in* Thompson 1916:475–476, pl. 6, fig. 2 (original description; holotype, USNM 76862, W coast Patagonia between Wellington Is. and mainland, 355 m).—Mann 1954:186 (listed from Chile).—Marshall and Iwamoto, *in* Marshall 1973:540 (listed).

Coelorhynchus (Coelorhynchus) patagoniae: Gilbert and Hubbs 1916:144 (listed); 1920:426 (in key).

Garichthys fasciatus: Whitley 1968:38 (New Zealand records).

DIAGNOSIS (from South American specimens only).—A species of *Coelorinchus* with a moderately large light organ (length more than half diameter of pupil) situated immediately before anus and with a large lenticular dermal window extending forward more than half distance to pelvic-fin bases. Subopercle produced into an acute point. Height first dorsal fin about equal to postrostral length of head. Snout short, 29–33

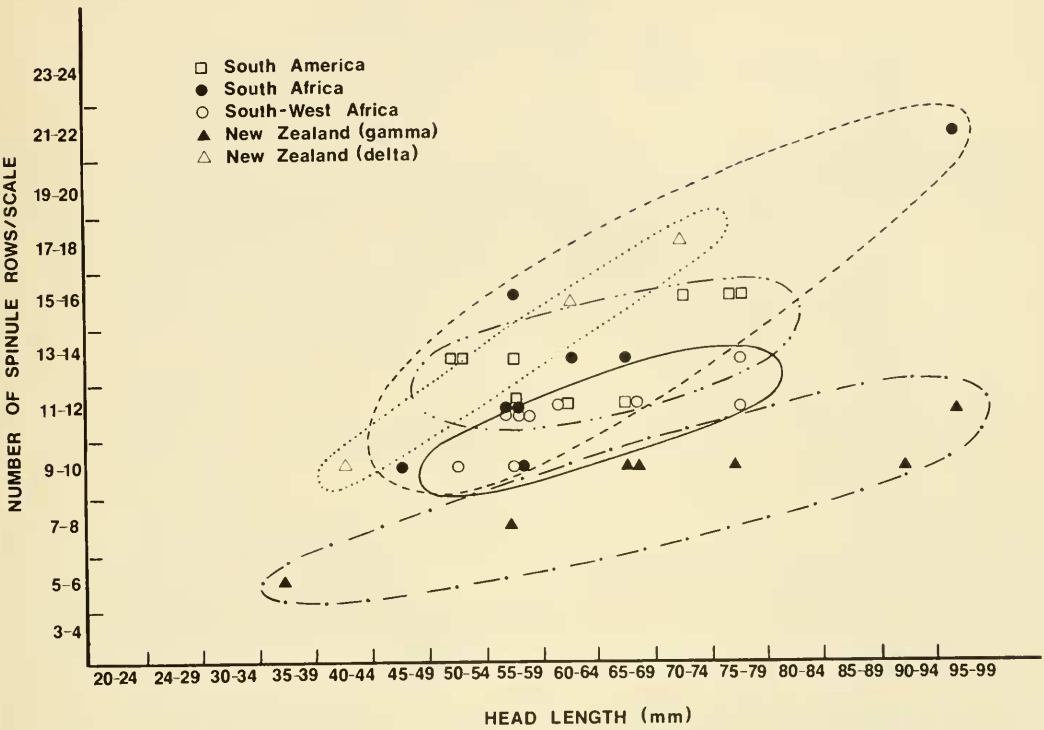

FIGURE 12. Scatter diagram showing relationship of head length to number of spinule rows on largest scales of body in five populations of *Coelorinchus fasciatus*. See text for discussion of populations.

percent HL, much less than huge orbits (39–46 percent of HL). Mouth small, upper jaw 25–31 percent HL. Ventral surfaces of head naked; head ridges relatively low; body scales with multiple, slightly divergent rows of reclined, imbricate spinules that form distinct low ridges over entire exposed field. Scales large, 3 to 4½ below midbase of first dorsal, usually 21–24 lateral-line scales over distance equal to predorsal length. Gill-rakers few, 7–9 total in inner series of outer arch.

DESCRIPTION (from South American specimens; see section on geographic variation for discussion of other populations).—Günther's (1887: pl. 28, fig. A) figure (reproduced in Fig. 11) is accurate and a good representation of the species. Head wide, slightly deeper than wide in larger specimens examined, but wider than deep in smaller specimens; length about 4.5 into TL. Orbits huge, diameter much greater than snout length or postorbital length, forming deep concavities in roof of skull. Snout relatively blunt, viewed dorsally or laterally. Mouth relatively small, opening somewhat restricted laterally by folds of skin; upper jaw extends posteriad about to below midorbit. Subopercle with slightly pointed posteroventral tip that extends beyond posteroventral angle of preopercle. Ridges of head relatively low, not prominent except for suborbital ridge, which forms a sharp demarcation between naked ventral portion of head and scaled dorsal portion. Anterolateral edges of snout not supported by bone. Opercular openings restricted. Gill membranes broadly attached to isthmus, without posterior free fold. Gill filaments moderately long; rakers very low, tubercular.

Premaxillary and dentary dentition consists of relatively broad, short bands of cardiform teeth. Premaxillary band ending well short of posterolateral opening of mouth.

Scales large, strongly adherent on thick, opaque head covering, somewhat more deciduous on body. Scale spinules very small (except on head ridges), close-packed, reclined, imbricate, and aligned in sharp, low, ridgelike rows. Spinule rows slightly divergent (generally more so on head), number of rows varying with size of

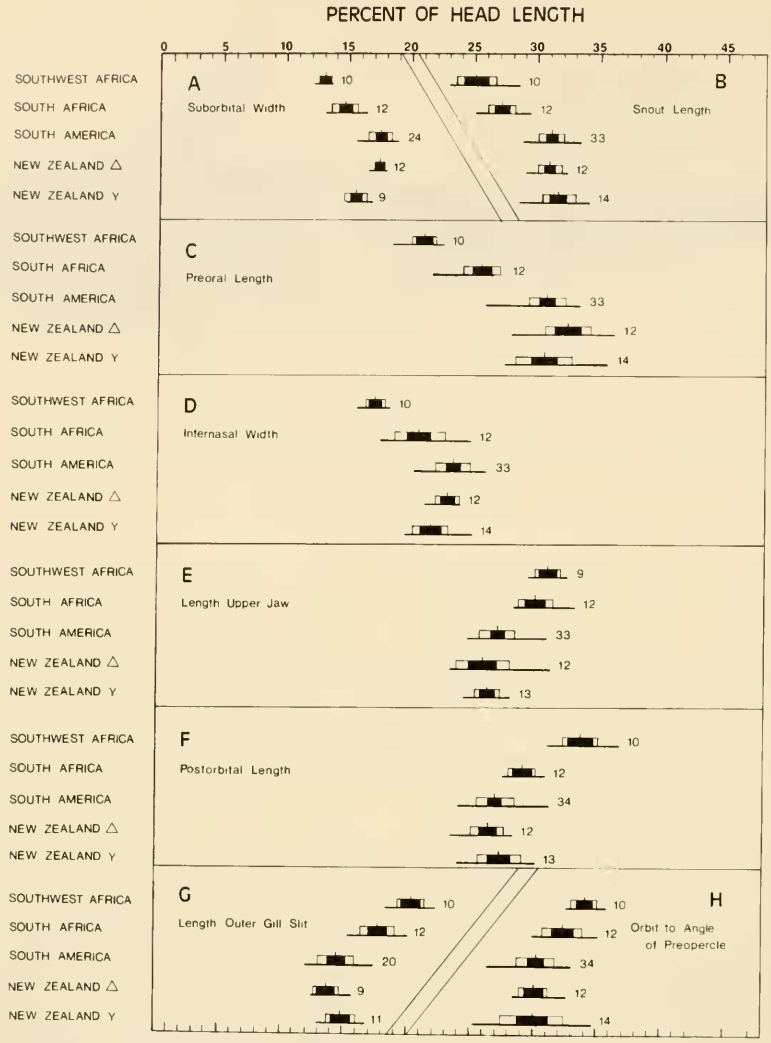

FIGURE 13. Comparison of eight morphometric features in five populations of *Coelorinchus fasciatus* using graphic methods of Hubbs and Hubbs (1953). See text for discussion of populations.

scale and size of individual (see Fig. 12). Entire ventral surface of head naked; naked areas on dorsal surface restricted to nasal fossae and narrow lunate area behind leading edge of snout.

First dorsal fin long, height about equal to postrostral length of head. Spinous second ray not produced beyond other rays; leading edge of distal portion sometimes armed with a few small denticles. Paired fins moderate in length, both pectoral and pelvic fins extending beyond vertical through anus. Outer ray of pelvic fin thick, prolonged, extending beyond first several anal rays. Anal fin well developed over entire length, much higher than second dorsal.

Coloration in alcohol overall somewhat tawny to medium brown. Ventral surfaces of head generally paler than remainder of head and body, but sometimes peppered with small melanophores. Lining of buccal, branchial, and peritoneal cavities usually blackish. Gill arches blackish but filaments pallid. Most fins blackish, but pelvic base sometimes whitish. Seven or more wide, sometimes rather faint, saddle marks on trunk and tail starting from nape.

Gas bladder (Fig. 3A) very large, bilobed anteriorly with tough, opaque, white, external tunic. In a 52-mm-HL female (CAS-SU 23006), left lobe contained 4 small retia and gas glands,

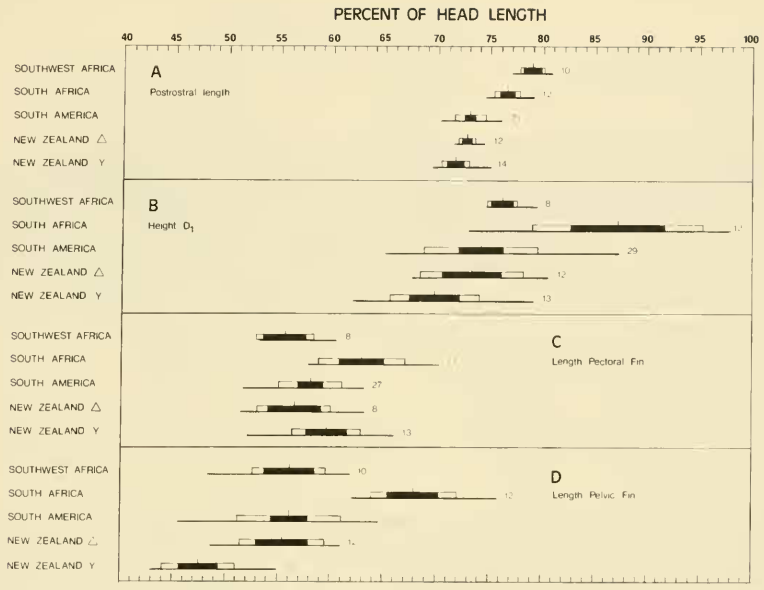

FIGURE 14. Comparison of four morphometric features in five populations of *Coelorinchus fasciatus* using graphic methods of Hubbs and Hubbs (1953). See text for discussion of populations.

right lobe 2 retia and gas glands. In 62-mm-HL male from Patagonia (CAS 14528), left and right lobes each had two rete-gas gland combinations, and posterior chamber had one; large drumming muscles present on lateral sides of anterior lobes. In two other specimens from New Zealand waters (LACM 11238, 65 mm HL, and LACM 10968–13, 60 mm HL) each anterior lobe had 2 rete-gas gland combinations and none in posterior chamber.

Coiling of alimentary canal very complex and much like that illustrated for *C. tokiensis* (Steindachner and Döderlein, 1887) by Okamura (1970b: fig. 65C). Pyloric caeca long, slender, unbranched, 16, 17, 18, and 19 in four specimens.

Light organ moderate in size, length longer than half pupil diameter; large, lens-shaped dermal window on abdomen immediately anterior to anus, falling well short of level of pelvic-fin bases.

MEASUREMENTS.—Summarized and compared by population in the graphs in Figures 13, 14, and 15.

COUNTS (combined for all populations).—1D. II, 9–10 (rarely 8 or 11); pect. i15–i19 (usually i16–i17); gill-rakers, first arch 7–9; second arch 7–9 (rarely 10), scales below 1D. 4–5½; below midbase of 1D. 3–4½; below 2D. 3–4½; over distance equal to predorsal length of head 20–27 (usually 23–24).

GEOGRAPHIC VARIATION.—Examination of scattered collections from the South Atlantic and South Pacific suggests the possible presence of four or five distinct populations of this widely distributed species. These populations may each warrant formal taxonomic recognition based on the differences noted below, but such recognition is premature until adequate samples of each are examined. A detailed study of additional *Coelorinchus* material from off New Zealand, southern Australia, and the southeastern coast of Africa is particularly needed. Study of the literature reporting *Coelorinchus* species from the western South Pacific suggests the likelihood of closely related Australian-New Zealand species having been confused in the past with *C. fasciatus*. Scott (1970:42–43), in his key to the Australian and New Zealand species of *Coelorinchus*, appears to have correctly recognized the valid nominal species of that region and the principal features that characterize each, but it is obvious that he worked primarily from the literature and not from extensive study material. The subtle but consistent differences I have found in populations of *C. fasciatus* from off New Zealand are not likely to be recognized in

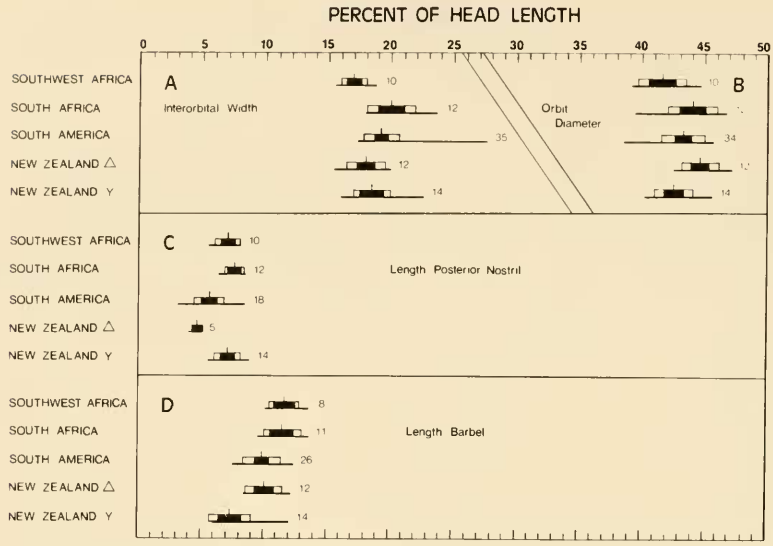

FIGURE 15. Comparison of four morphometric features in five populations of *Coelorinchus fasciatus* using graphic methods of Hubbs and Hubbs (1953). See text for discussion of populations.

studies using limited material from restricted areas.

From study of material currently available to me, it appears that the various populations of *C. fasciatus* can be broadly characterized by several morphometric features, as compared in Figures 13, 14, and 15 using the graphic methods described by Hubbs and Hubbs (1953). It should be borne in mind when examining these diagrams that the sample sizes are generally too small to give statistically significant comparisons—the graphs are offered, however, to point out possible differentiating characters and character trends that should be the focus of subsequent investigations.

Eastern South Atlantic specimens appear to vary in a clinal pattern from South American specimens. Figures 13, 14, and 15 show considerable differences between South-West African and South American specimens in: (1) suborbital width; (2) snout length; (3) preoral length; (4) internasal width; (5) upper jaw length; (6) postorbital length of head; (7) outer gill-slit length; (8) length orbit to angle of preopercle; and (9) postrostral length of head. In these characters there is little if any apparent overlap between the two populations. However, the distributions for these same characters in South African specimens fall in an almost perfectly intermediate position, overlapping the distributions in the characters of both opposing populations. Were these South African specimens not so perfectly intermediate, one might suspect, even with the limited comparative material, that the South-West African population is a species distinct from the South American *C. fasciatus*.

Additional to these differences in morphometry between South-West African specimens (Fig. 16) and those from South America are differences in the shape of various parts of the head and body. Thus the mouth opening is much less restricted laterally in South-West African specimens, the opercle-subopercle height is deeper (about 1.05–0.85 of orbit cf. about 0.85–0.65), the posteroventral angle of the subopercle is rounded (rather than distinctly acute and usually flaplike), the profile of the nape is generally more strongly arched, and the dorsal profile behind the dorsal-fin origin is more angular in its descent to the tip of the tail. Saddle markings on the body are completely absent in the 10 South-West African specimens examined and are generally faint in the South American specimens, although Günther's illustration (1887; pl. 28, fig. A) of a specimen from "the east coast of the southern extremity of South America" is boldly marked with saddlelike blotches. The anterior dermal window of the light organ is mostly covered with scales in the South-West African specimens (and partially covered in South African specimens) but broadly exposed in specimens from other areas.

Again the South African specimens tend to be intermediate in these characters, but, in addition,

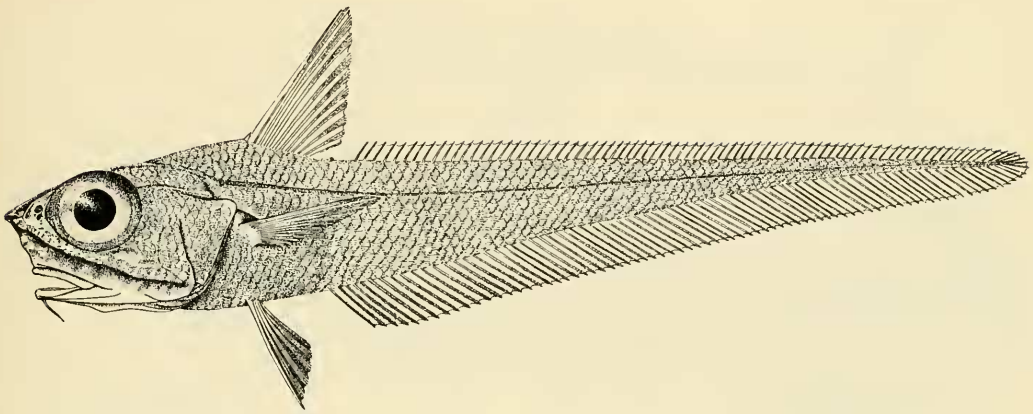

FIGURE 16. *Coelorinchus fasciatus* (Günther), specimen from South-West Africa in 220 m (after Poll 1953:fig. 94).

they show a measure of distinctness of their own, notably in their apparently longer paired fins and higher first dorsal fin (Fig. 14) than in any of the other populations compared. South African specimens I have examined appeared faded and lacked any trace of saddle marks on the body, but Smith (1953:fig. 236) illustrated a 35.5–cm specimen that had distinct saddlelike blotches on its trunk and tail, and Barnard (1925:340–341), in calling the species Banded Rat-tail, described the coloration as "usually with a series of dark blotches forming irregular cross-bands."

The two African populations are obviously closer related to each other than they are to the other populations of *C. fasciatus* recognized here, despite the distinct clinal pattern they show in certain characters. African specimens are set apart from South American and New Zealand specimens in having (1) a longer postrostral length of head, (2) a shorter snout, (3) a shorter preoral length, (4) a narrower suborbital width, (5) a longer upper jaw, (6) a longer outer gill-slit, (7) a somewhat longer posterior nostril (than South American and New Zealand delta specimens but not New Zealand gamma specimens), (8) a more narrowly exposed anterior dermal window of the abdominal light organ, (9) a longer rictus, and (10) a somewhat greater opercle-subopercle height.

It seems that the African populations either became separated from the more westerly populations at an earlier date than the apparent split in the New Zealand and South American populations, or the degree of isolation was greater. Whatever the case, the amount of differentiation that has taken place between African and South American populations, on the one hand, is much greater than that between South American and New Zealand populations on the other hand.

The specimens that I have called New Zealand delta scarcely differ from the South American specimens of *C. fasciatus*, although they tend to be more boldly marked, with broader and darker saddle marks and, in some, a pale stripe over a dark, ground color on the posterior portion of the anal fin that is missing in their New World counterpart. Specimens from the two areas are otherwise so apparently close that there is little reason to consider them anything but populations of the same species.

The New Zealand gamma population is, on the other hand, farther removed from the New Zealand delta populations than the later is to the South American populations. The gamma specimens tend to have fainter saddle markings on the body, a more lobate preopercle, a smaller barbel and larger posterior nostril (Fig. 15, c & d), a somewhat shorter pelvic fin and narrower suborbital space, fewer spinule rows on the scales (Fig. 12), and more pyloric caeca (21, 28, 29, and 30 in 4 specimens cf. 15–19 in other populations). Furthermore, most of the specimens have small patches of scales on the ventral surface of the preopercle, the dorsal fin is generally black tipped, and the posterior portion of the anal has a black stripe over a pale ground. The large number of pyloric caeca appears to distinguish this population from all others of the species. I have examined too few collections of the two forms off New Zealand to say anything

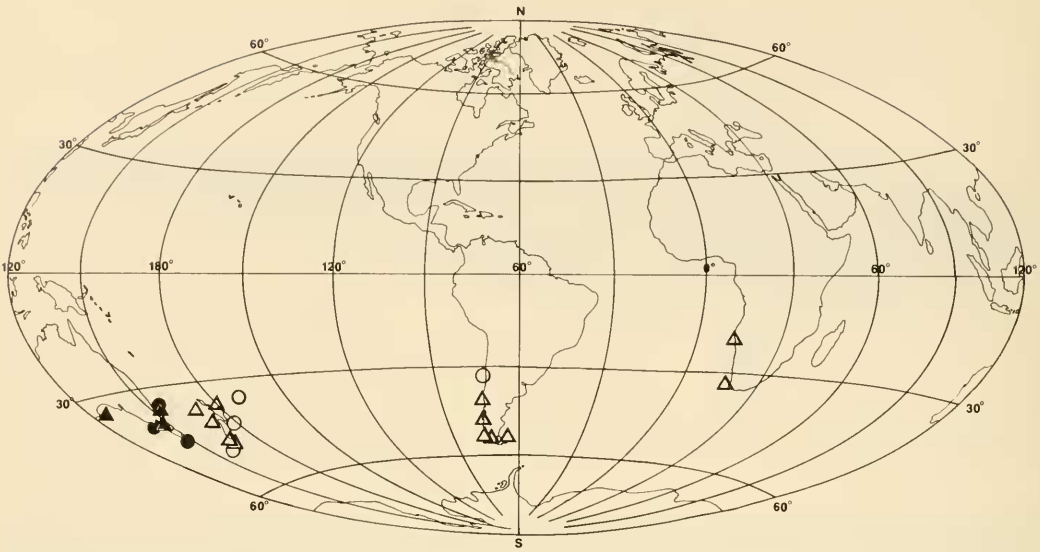

FIGURE 17. General distributions of *Coelorinchus fasciatus* (triangles) and *C. innotabilis* (circles). Open symbols represent capture sites of specimens examined; closed symbols represent capture sites reported in the literature.

definite, but it seems that the delta form is found along the southern portion of the New Zealand plateau while the gamma form is found farther north. It will be interesting to examine Australian and Tasmanian collections of *C. fasciatus* to see if they fall into either of the New Zealand forms.

COMPARISONS.—*C. fasciatus* appears to be most closely related to the Australian species *C. mirus* McCulloch, 1926, from which it differs primarily in having a larger orbit, shorter barbel, different coloration, and fewer spinule ridges on the scales (see Scott, 1970, for additional characters). It is also fairly close to *C. aconcagua* from Chile, but is readily distinguished from that species by characters given in the key and in the description of *C. aconcagua*. The longer snout, smaller orbits, shorter first dorsal fin, and fewer spinule rows on scales of *C. chilensis* make that species unlikely to be confused with *C. fasciatus*.

REMARKS.—Gilbert and Thompson (*in* Thompson 1916:475) described *C. patagoniae* from a single immature specimen of 125 mm TL and compared their new species with *C. chilensis*, from which it differs in having a shorter snout, fewer scales above the lateral line, and other features. Surprisingly, they neglected to compare their small holotype with the much larger *C. fasciatus* specimens they reported from the same ALBATROSS station (no. 2784) or those from the previous stations (2783). Comparison of these ALBATROSS *C. fasciatus* specimens with the holotype of *C. patagoniae* leaves no doubt as to their conspecificity. The apparent absence of saddle marks in the holotype of *C. patagoniae* is not unusual in that most *C. fasciatus* specimens from ALBATROSS stations 2783 and 2784 are badly faded, and they also appear to lack saddle marks.

DISTRIBUTION.—The species has a subantarctic distribution (Fig. 17), having been taken from Australian-New Zealand waters, off both sides of the southern extremity of South America, and off southern Africa, at depths of 73–823 m.

MATERIAL EXAMINED. Eastern Pacific off South America (31 specimens, 8 localities):—MNHN, Santiago P.5.423 (1, 21 mm HL, 97 mm TL), 41°40′03″S, 73°40′05″W, 275 m, 24 Apr. 1966.—MNHN, Santiago 660037 (1, 62 HL), 41°41′04″S, 74°40′05″W, 250 m, CARLOS DARWIN, 24 Apr. 1966.—MNHN, Santiago uncat. (1, 53 HL), 42°53′00″S, 72°53′00″W, 150 m, CARLOS DARWIN, 9 Apr. 1966.—MNHN, Santiago uncat. (1, 73 HL), 43°00′08″S, 73°00′04″W, 200 m.—USNM 77290 (3, 46–56 HL, 200+ −242 TL), USNM 76862 (holotype of *C. patagoniae* Gilbert and Thompson, 29 HL, 125 TL), and CAS-SU 23006 (3, 50–56 HL), 48°41′S, 74°24′W, 355 m, beam trawl, ALBATROSS sta. 2784, 8 Feb. 1888.—USNM 77289 (2, 54–62 HL, 215+ − 280 TL), 51°02′30″S, 74°08′30″W, 223 m, beam trawl, ALBATROSS sta. 2783, 6 Feb. 1888.—LACM uncat. (10, 42–68 HL, 180–284 TL), 52°51′S, 74°13′W, 494–552 m, 12-m otter trawl, ELTANIN cr. 21, sta. 22A, 7 Jan. 1966.—LACM 11158-4 (8, 30–60 HL, 153–260 TL), Straits of Magellan, 52°53′–50′S, 74°05′–10′W, 544 m, 1.5-m Blake trawl, ELTANIN sta. 1605, 1 Apr. 1966.

Western South Atlantic (8 specimens, 3 localities):—CAS 14528 (3, 59–63 HL, 282–309 TL), Argentina, off Patagonia,

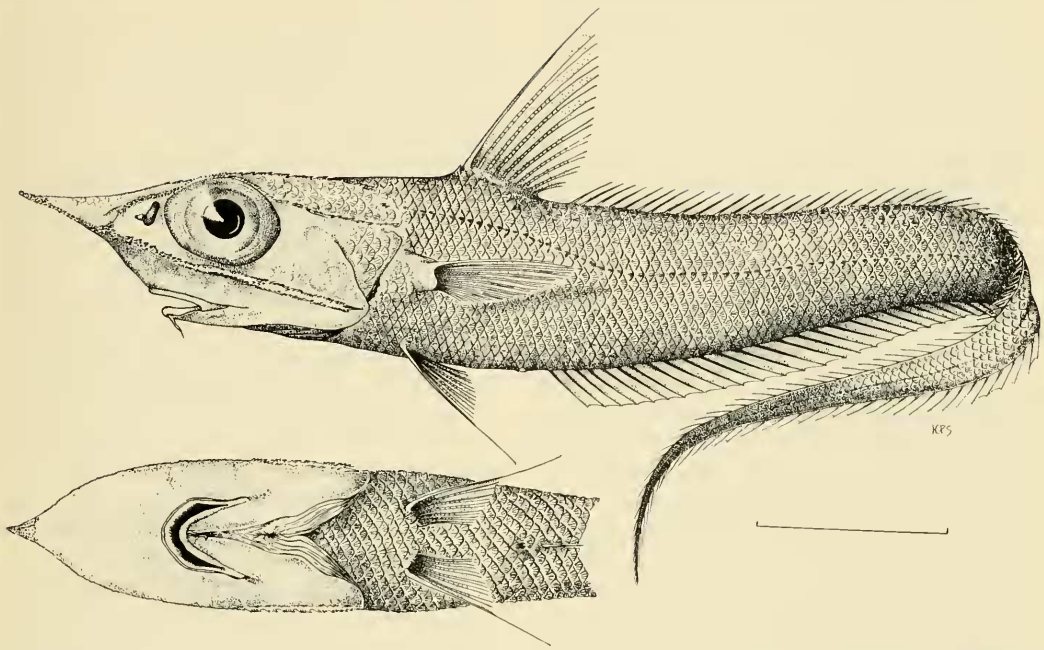

FIGURE 18. *Coelorinchus innotabilis* McCulloch, CAS 38314, 51-mm-HL specimen taken off Chile in 580 m. Scale line represents 25 mm.

KAYO MARU sta. 10.—USNM 103797 (1, 66 HL, 304+ TL), W of Falkland Is., 52°23′S, 65°19′W.—LACM 10458–2 (4, 58–76 HL, 275–330 TL), off Falkland Is., 53°05′–08′S, 59°31′–24′W, 512–585 m, 12-m otter trawl, ELTANIN sta. 339, 3 Dec. 1962.

Western South Pacific (form gamma) (23 specimens, 4 localities):—LACM 11238 (2, 65–92 HL, 280–440 TL), New Zealand, North Is., Bay of Plenty, 37°49′S, 178°50′E, 732 m, 12-m otter trawl, ELTANIN sta. 1713, 28 May 1966.—LACM 11490 (1, 62 HL, 290 TL), New Zealand, W of North Is., 38°18.4′S, 169°23.1′E, 519 m, Blake trawl, ELTANIN sta. 2200, 31 May 1968.—LACM 11335 (1, 35 HL, 175 TL), New Zealand, W of Cook Strait, 41°32′–31′S, 174°34′–32′E, 238 m, 1.5-m Blake trawl, ELTANIN sta. 1847, 19 Dec. 1966.—LACM 10968–9 (1, 71 HL, 325 TL) and LACM 10968–13 (10, 58–100 HL, 240+ –440 TL), E of Chatham Is., 44°00′–03′S, 178°06′–09′W, 430 m, 12-m otter trawl, ELTANIN sta. 1398, 29 Nov. 1964.

Western South Pacific (form delta) (12 specimens, 2 localities):—LACM 109771 (3, 58–71 HL, 244+ –293+ TL), SW of New Zealand, 51°00′–01′S, 162°01′E, 371 m, 1.5-m Blake trawl, ELTANIN sta. 1411, 8 Feb. 1965.—LACM 11084–1 (6, 31–41 HL, 144–188 TL) and LACM 11084–2 (3, 42–50 HL, 185+ –224 TL), New Zealand slope near Campbell Is., 53°29′–30′S, 169°48′–45.2′E, 595 m, Blake trawl, ELTANIN sta. 1989, 1 Jan. 1968.

South-West Africa (10 specimens, 1 locality):—MRAC 95772–95781 (10, 51–79 HL, 241–360 TL), 83.7 km S by W of Fort Rock Point, 19°52′S, 12°20′E, 220 m, Expédition Océanographique Belge Atlantique Sud, sta. 108, 25 Jan. 1949.

South Africa (12 specimens, 6 localities):—SAM 12560 (1, 49 HL, 262 TL), Table Bay, 285 m.—SAM 12562 (5, 58–63 HL, 255+ –324 TL), Table Bay, 155 m.—SAM 12563 (1, 69 HL, 320 TL), Table Bay, 240 m.—SAM 12570 (3, 19–38 HL, 104–156 TL), Table Bay, 282 m.—SAM 12576 (1, 48 HL, 200+ TL), 36°40′S, 21°26′E, 366 m.—SAM 16375 (1, 99 HL, 420+ TL), Table Bay, 366 m.

Coelorinchus innotabilis McCulloch, 1907

(Figures 5B, 7G, 18, 19)

Coelorhynchus innotabilis McCulloch, 1907:348–349, pl. 63, fig. 2, 2a (original description; illustrations; holotype, 138 mm long, and one paratype, 110 mm, both from 56 km E of Sydney, Australia, 1463 m); 1919: 32 (list), pl. 11, fig. 115a (illustration); 1926:180–181 (6 specimens, from eastward of Bass Strait by "Endeavour").

Coelorhynchus (Paramacrurus) innotabilis Gilbert and Hubbs, 1916:144 (list); 1920:429 (in key).

DIAGNOSIS.—A species of *Coelorinchus* with anus slightly removed from anal fin. Ventral light organ small, not generally visible from exterior, its length about 0.5–1.0 into pupil diameter. Subopercle with a narrow ventral point. Body long and slender, greatest depth usually 8–12 into TL. Snout slender, sharply pointed, length 41–46 percent HL. Scales with spinules arranged in sharp, slightly divergent ridgelike rows but with no enlarged median row; no scales on ventral aspects of head except along anterolateral margins of snout in large specimens. Mouth small, upper jaw 21–23 percent of HL. First dorsal-fin height less than postrostral length of head; interspace be-

tween first and second dorsal fins short, less than length of base of first dorsal; height of second dorsal moderate, anteriorly almost as high as anal.

Description of Eastern Pacific Specimen (CAS 38314, 51 mm HL).—A long slender fish with sharply pointed snout. Head about as wide as deep. Trunk and tail moderately compressed laterally. Anus slightly removed from origin of anal fin by a distance about half diameter of pupil. Median and lateral processes of nasal bones connected and forming a complete bridge across anterolateral edges of snout. Head ridges stout, sharp; suborbital ridge separates head into dorsal and ventral parts. Occipital and postorbital ridges formed of sharply serrated, keellike, median spinule rows on scales; median rostral, supranasal, and supraorbital ridges low, not formed of sharp, keellike scales. Suborbital ridge posterior to area below middle of orbit composed of two rows of scutelike scales that form a double-crested ridge. Interopercle completely hidden behind preopercle; ventral tip of subopercle produced into a flexible, pointed tab, its tip slightly exposed beyond posteroventral margin of preopercle. Barbel thin, short, less than diameter of pupil.

Scales on body of moderate size and covered with short, reclined spinules, each aligned in close longitudinal rows (8 or 9 rows in large trunk scales); outer rows on field very slightly divergent from middle rows. Posteriormost spinules extend beyond scale margin. Middle spinule row not enlarged. Scales on head generally with more divergent spinule rows. Scales dorsally on head mostly without spinules. No enlarged scutelike scale at posterior end of occipital sensory canal or at anterior end of supraoccipital crest. Broad areas around nostrils and behind leading anterolateral margin of snout naked. Terminal snout scute somewhat arrowhead shaped in dorsal view, dorsoventrally flattened, and armed with several longitudinal rows of small spinules, the rows diverging posteriorly from the anterior apex.

Light organ very small, externally manifested only in a blackish median streak before anus. Luminescent gland housed within body wall and in a flattened, black, bulbous structure connected by a short pedicellike tube to rectum. Entire length of gland and tube about equal to half pupil diameter.

Gill membranes broadly connected to isthmus without a free posterior fold. Gill slits restricted, the outermost about as long as pupil diameter. Uppermost (epibranchial) gill-rakers padlike; lower rakers tubercular and armed with very small spines.

Fins generally small; first dorsal fin shorter than postrostral length of head. Long spinous second ray of first dorsal fin barely if at all extending beyond adjacent segmented rays. Second dorsal fin close behind first dorsal fin, their interspace less than length of base of latter. Anteriormost rays of second dorsal fin relatively long for a macrourine grenadier, slightly shorter, but distinctly slimmer than anterior rays of anal fin; fin height diminishes posteriorly. Uppermost ray of pectoral fin a slender splint, closely adhered to second ray. Outer pelvic ray somewhat prolonged beyond inner rays and reaching to anteriormost 1–3 anal rays. Inner rays extend, at most, only to anus.

Intestine multiply looped and somewhat similar to that of *C. smithi* Gilbert and Hubbs, 1920, illustrated by Okamura (1970b: fig. 65D). Pyloric caeca number not determined for eastern Pacific specimen because of everted stomach and consequent threat of undue damage if dissected. Two New Zealand slope specimens had 7 and 9 short, unbranched caeca. Eggs in ovaries of eastern Pacific specimen well developed, largest about 0.8 mm in diameter. Gas bladder in a New Zealand specimen had four large retia and gas glands.

Coloration in alcohol generally light brown, but abdomen and operculum blackish, and ventral surfaces of head somewhat greyish. Fins all blackish or dusky. Oral, branchial, and peritoneal linings black. Gill arches blackish, but rakers and filaments pallid.

Measurements.—Total length 136+ −320 mm, head length 29–82 mm. The following in percent of head length, measurements for eastern Pacific specimen first, followed by data for western Pacific specimens [range ($\bar{x}$; n; SD)]: postrostral length of head 61.3 [55.7–61.0 (57.46; 13; 1.69)]; snout length 40.7 [40.1–46.1 (43.49; 13; 1.76)]; preoral length 42.1 [40.8–45.9 (43.58; 12; 1.59)]; internasal width 20.7 [19.6–23.1 (20.94; 13; 1.02)]; orbit diameter 31.6 [27.7–33.7 (31.11; 13; 2.07)]; interorbital width 20.0 [16.0–21.9 (18.25; 13; 1.68)]; postorbital length 28.3 [23.7–27.4 (25.33; 14; 1.02)]; orbit to angle of preopercle 31.2 [26.1–31.5 (27.81; 14; 1.66)]; suborbital width 13.8 [11.9–14.5 (13.17; 14; 0.60)]; upper jaw length 22.7 [20.3–21.7 (20.87; 11; 0.46)]; barbel

length 8.1 [5.0–7.6 (6.69; 11; 1.25)]; outer gill-slit length 11.9 [6.7–9.5 (8.11; 14; 0.96)]; preanal length 143.3 [137.0–157.3 (145.22; 11; 6.52)]; outer pelvic to anal 34.0 [32.6–42.6 (38.61; 14; 2.84)]; isthmus to anal 61.9 [54.3–70.6 (64.08; 13; 5.20)]; greatest body depth 49.0 [35.2–50.5 (42.11; 13; 4.77)]; depth over anal origin 41.9 [30.9–43.8 (36.51; 14; 3.94)]; 1D.–2D. interspace 7.1 [9.1–18.4 (12.32; 14; 2.37)]; 1D. height 53.4 [44.0–53.6 (50.14; 8; 3.15)]; pectoral fin length 45.4 [37.4–45.3 (41.30; 10; 2.88)]; pelvic fin length 41.5 [33.2–46.6 (38.79; 13; 3.35)].

COUNTS (eastern Pacific specimen given first followed by range of counts for western Pacific specimens).—1D. II,10 (II,9–10); pect. 21 (17–19); gill-rakers, outer arch 2 + 7 (1–2 + 6–7, usually 2 + 6); second arch 2 + 7 (1–2 + 6–7); scales below 1D. 9 (5½–6½); below 2D. 7 (5–7); below mid-1D. 6½ (4½–5½); over distance equal to predorsal length 48 (37–40); pyloric caeca (7 and 9 in two western Pacific specimens).

COMPARISONS.—The eastern Pacific specimen agrees closely with the original description of *C. innotabilis*, which was based on two small specimens. It also compares closely with LACM specimens from the western South Pacific except for slight differences in pectoral-ray, gill-raker, and scale-row counts. The eastern Pacific specimen has 9 rows of scales below the first dorsal fin origin, 6½ below the mid-base of the first dorsal, and 48 lateral-line scales over a distance equal to the predorsal length. Comparable figures for western Pacific specimens were 5½–6½, 4½–5½ and 37–40. The body appears to be slightly deeper, the postorbital, upper jaw and the barbel slightly longer, the outer gill slit decidedly longer, and the interspace between the dorsal fins shorter in the eastern Pacific specimen. In most other features, however, it agrees with the western Pacific specimens, especially if size-related changes are considered. Thus, in specimens of *C. innotabilis* larger than about 65 mm HL the scales on the head are more strongly spinulated than those of smaller specimens; scales on the head that are without spinules in small specimens are densely covered with spinules in large specimens. The double-crested posterior part of the suborbital ridge in small specimens is a single broad crest in the largest specimens, and scales along the anterolateral margin of the snout override the edge of the suborbital ridge to form a lunate scaled area ventrally in the largest specimens, but not the smaller ones. In some New Zealand specimens the second spinous ray of the first dorsal fin is blackish distally. Most western Pacific specimens have a blackish edge around the entire orbit, while in the eastern Pacific specimen the orbit is blackish only anteriorly and dorsally. These slight coloration differences are probably negligible; I have examined specimens of *C. coelorhincus carminatus* from the western Atlantic that showed even greater color variation (Marshall and Iwamoto, *in* Marshall 1973:558), and *C. fasciatus* populations, noted earlier, show considerable differences in body markings. If additional material from the eastern Pacific shows a consistent difference in the characters noted above, it may be reasonable to consider the population as distinct at the specific or subspecific level from that of the western Pacific, but such designation at present is unwarranted.

In the eastern Pacific, *C. innotabilis* is likely to be confused only with *C. chilensis* with which it shares a long pointed snout, naked ventral snout surface, and small ventral light organ. *C. chilensis*, however, has much coaser scale spinulation, fewer, more divergent rows of spinules on the scales (with most scales having an enlarged median spinule row), a lower second dorsal fin, a larger space between the dorsal fins, a shorter snout (34–40 percent HL compared with 40–46 in *innotabilis*), and usually fewer segmented first dorsal fin rays (normally 7–8, occasionally 9, compared with 9–10 in *innotabilis*).

DISTRIBUTION.—*C. innotabilis* is known from both sides of the South Pacific between latitudes 33°S and 53°S (Fig. 19). Compared with others of the genus, it is a species of moderate depths, having been taken between 580 and 1463 m. In the eastern Pacific it is apparently sympatric with *C. chilensis*, a species with which the single known Chilean representative was captured. Although *C. aconcagua* is found within the same latitudinal coordinates off Chile, that species appears to dwell at somewhat shallower depths of about 119–450 m.

MATERIAL EXAMINED (19 specimens, 7 localities). Eastern Pacific:—CAS 38314 (1, 51 mm HL, 215 mm TL), off Chile, 32°17′S, 71°39.5′W, 580 m, 22-m otter trawl, ANTON BRUUN cr. 18A, sta. 702 (field no. LWK 66–44), 11 Aug. 1966. Western Pacific:—LACM 11238 (4, 34–43 HL, 182–297 TL), New Zealand, North Is., Bay of Plenty, 37°49′S, 178°50′E, 732 m, 12-m otter trawl, ELTANIN sta. 1713, 28 May 1966.—LACM 11241–5 (5, 29–51 HL, 136–198 TL) and LACM 11241–7 (3, 52–54 HL, 198–203+ TL), off New Zealand, 38°27′–30′S, 168°07′–04′W, 659 m, 3-m Blake trawl, ELTANIN sta. 1718,

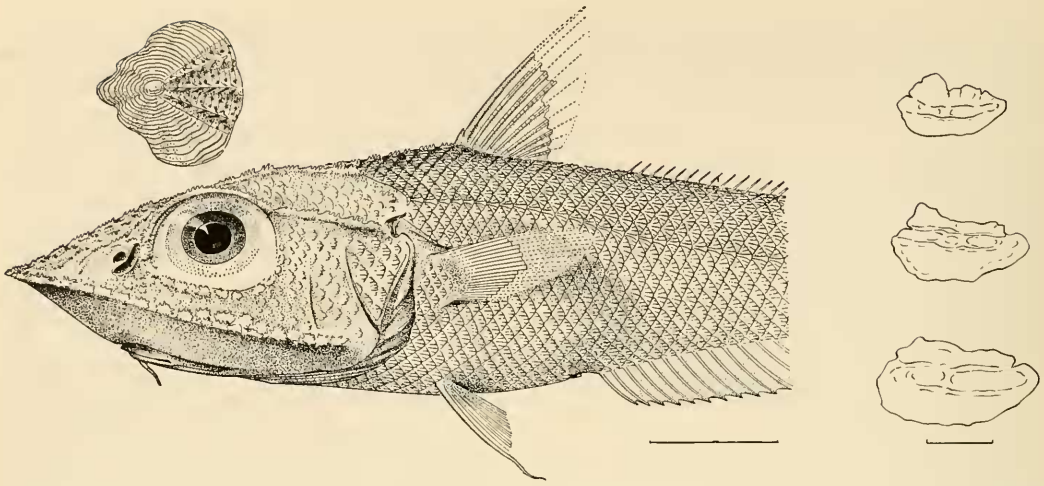

FIGURE 19. *Coelorinchus chilensis* Gilbert and Thompson. Illustration of scale and lateral view of fish from Thompson (1916:pl. 6, fig. 1). Scale line below anal fin represents 25.4 mm. Drawings of right otoliths from CAS 38319 (43 mm HL) (top), CAS 39319 (71 mm HL) (middle), and CAS uncat. (95 mm HL) (bottom). Scale line below otoliths represents 5 mm.

12–13 July 1966.—LACM 11312-2 (2, 60–62 HL, 237–260+ TL), New Zealand, E of Cook Strait, 40°15′–17′S, 168°16′–18′E, 915 m, 3-m Blake trawl, ELTANIN sta. 1818, 2 Dec. 1966.—LACM 11485-1 (1, 67 HL, 280+ TL), New Zealand slope, E of South Is., 43°48.2′S, 174°24′–26.3′E, 909 m, ELTANIN sta. 2198, 12 May 1968.—LACM 11449-2 (1, 74 HL, 320 TL), S of Tasmania, 47°11′10′S, 147°47′–46′E, 1034 m, 3-m Blake trawl, ELTANIN sta. 1983, 24 Feb. 1967.—LACM 11085-1 (2, 51–82 HL, 250–300 TL), SW of Campbell Is., 53°49′–52.2′S, 169°57.2′–56.1′E, 971 m, Blake trawl, ELTANIN sta. 1990, 1 Jan. 1968.

Coelorinchus chilensis Gilbert and Thompson, 1916

(Figures 3C, 5A, 7H, 8, 19, 20B)

Coelorhynchus chilensis Gilbert and Thompson, *in* Thompson 1916:473–474, pl. 6, fig. 1 (original description; illustration; holotype and numerous paratypes from ALBATROSS sta. 2791 off Lota, Chile, in 1238 m).—Makushok 1967:209, table 18 (depth: distribution).—Pequeño 1971:278–281, fig. 5 (description; illustration; 4 specimens, 3 localities, 235–424 m).

Coelorhynchus (Oxymacrurus) chilensis: Gilbert and Hubbs 1916:145 (listed); 1920:429 (in key).

DIAGNOSIS.—A species of *Coelorinchus* with a small ventral light organ, its length less than half pupil diameter. Ventral surfaces of head naked. Subopercle bone with a narrow, ventrally pointed tip. Dorsal-fin height less than postrostral length of head. Snout sharply pointed, length about equal to or longer than orbit diameter. Mouth very small, 20–29 percent of HL. Chin barbel short, 5–7 percent of HL. Premaxillary teeth in short broad bands which do not extend to posterior edge of mouth opening.

General shape as in Figure 19. Head somewhat depressed; width over preopercles slightly more than greatest head depth. Trunk and tail laterally compressed; width of tail over anal-fin origin slightly less than twice depth over that point. Suborbital ridge stout, acute, separating the head into two parts, the ventral part relatively flattened and without scales, the dorsal part rounded and heavily scaled. Head ridges prominent, heavily reinforced by stout scutelike scales. Median rostral ridge on snout low and broad, with spinules relatively short and fine. Supranarial and supraorbital ridges narrow and low; postorbital and supraoccipital ridges narrow, with median spinules on scales in keellike row, forming a relatively high, sharp, ridge axis. A single, broad, scutelike scale at anteromedial end of nape (anterior end of supraoccipital crest); another single scale, this one with a median keellike ridge, at posterior end of occipital sensory canal (over posttemporal bone), just anterior to lateral-line origin (Fig. 5a). Interopercle completely covered by preopercle. Subopercle naked and ventrally pointed, the flexible tablike tip exposed beyond posteroventral margin of preopercle. Gill openings restricted; gill membranes broadly attached to isthmus and without free posterior fold. Gill filaments relatively long. Gill-rakers tubercular, coarsely armed with short, slender, sometimes recurved spines.

Body scales large and coarsely spinulated, with spinules arranged in distinct, slightly divergent, ridgelike rows. Spinules in each row larger

toward posterior margin of exposed field; middle row usually highest, with last spinule extending beyond margin of scale. Nasal fossa, entire ventral surface of head, and narrow margins along head ridges naked.

Fins all relatively small. First dorsal fin lacking any prolonged rays; fin height much less than postrostral length of head. Pelvic fins short and small, most rays falling well short of anal-fin origin, but the slightly prolonged outermost ray reaching just beyond that point.

Gas bladder well developed. The four retia mirabilia short, slender, each connecting to a small gas gland (Fig. 3C). Males have large sheetlike drumming muscles that encase most of the anterior third or so of the gas bladder. Anteromedial end of bladder slightly concave, with resultant bilobed appearance to bladder head. Development of anterior lobes slight compared to condition in *C. fasciatus* (Fig. 3A) and *C. occa* (Fig. 3B).

Intestinal coiling similar to that illustrated for *C. smithi* by Okamura (1970b:fig. 65D) and of a type similar to that of most other members of genus. Pyloric caeca moderately long, slender, unbranched.

Light organ small and scarcely discernible in exterior view; its only visible manifestation being a small, slightly swollen, blackish area anterior to anus.

Overall coloration in alcohol greyish-brown. Fins blackish. Oral, branchial, and peritoneal membranes blackish. Naked ventral surfaces of head whitish to dirty brown. Lips and chin barbel pallid.

Measurements.—Total length 123–483 mm; head length 34.0–102 mm. The following in percent of head length [range ($\bar{x}$; n; SD)]: snout length 34.0–40.1 (37.40; 39; 1.508); preoral length 31.0–37.2 (33.89; 39; 1.808); internasal width 18.2–22.4 (20.05; 39; 1.042); orbit diameter 29.0–38.3 (33.94; 39; 2.124); interorbital width 18.9–25.0 (22.06; 37; 1.529); postorbital length 25.5–31.1 (28.06; 39; 1.499); orbit to angle of preopercle 28.2–36.0 (31.12; 38; 1.718); suborbital width 13.3–16.8 (14.65; 37; 0.883); upper jaw length 20.0–29.2 (25.03; 37; 1.977); barbel length 3.9–10.0 (6.40; 37; 1.184); outer gill-slit length 9.5–17.7 (12.45; 35; 1.571); preanal length 131.8–150.4 (140.14; 36; 5.616); outer pelvic to anal 23.2–45.0 (30.86; 36; 4.330); isthmus to anal 47.2–72.5 (55.16; 37; 5.235); greatest body depth 45.3–60.7 (52.44; 31; 3.892); 1D.–2D. interspace 21.7–36.3 (29.114; 37; 4.564); 1D. height 41.4–49.3 (45.30; 39; 2.666); pectoral fin length 38.9–50.0 (42.46; 35; 2.621); pelvic fin length 31.3–42.0 (38.58; 32; 2.831).

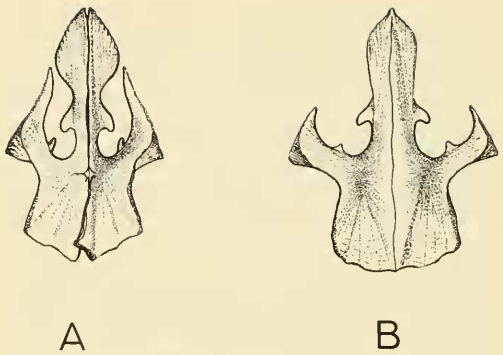

Figure 20. Dorsal view of nasal bones of (a) *Coelorinchus occa* and (b) *C. chilensis* comparing relative development of median and lateral processes in the two species.

Counts.—1D. II, 7–9; pect. i16–i21 (usually i18–i20); gill-rakers, first arch 1–2 + 7–9; second arch 1–2 + 6–8, scales below 1D. 4½–6 (usually 5½); below 2D. 3½–6 (usually 4½); below mid-1D. 3½–5 (usually 3½); over distance equal to predorsal length 33–41 (35.33; 21; 2.556); pyloric caeca 9–12 (n = 3).

Comparisons.—Of the eastern Pacific members of the genus, *C. chilensis* is likely to be confused only with *C. innotabilis* with which it shares a long, slender, pointed snout and a naked ventral snout surface. It is, however, readily distinguished from that species by its fewer scale rows below the first and second dorsal fins, longer interspace between the dorsal fins, more coarsely spinulated scales, and a smaller light organ. The combination of sharply pointed snout, naked ventral snout surface, coarsely spinulated scales, small light organ, and small mouth immediately separates *C. chilensis* from other eastern Pacific congeners.

Remarks.—*Coelorinchus chilensis* was relegated by Gilbert and Hubbs (1920:429) to the subgenus *Oxymacrurus*, apparently because of the relatively low median row of spinules on its scales, which contrasts with the very strong keellike median row in species of the subgenus *Oxygadus*. But in other characters given in their analytical key (anus immediately before anal fin; second dorsal spine less than postrostral length of head; body without dark markings), *C. chilensis* agrees with both *Oxygadus* and *Oxymacrurus*.

Okamura (1970a:153–154) used other characters besides the size of the median spinule row to distinguish the two subgenera. Thus he characterized *Oxymacrurus* as having the anterolateral margin of the nasal bones entire, the luminous organ decidedly longer than half the pupil diameter, no scute at the posterior end of the occipital sensory canal, and median rostral series of scales flanked on each side by a single series of scales. *Oxygadus*, in contrast, supposedly has a broad gap between the median and lateral processes of the nasal bone (anterolateral margin is thus interrupted), a very small luminescent organ whose length is less than half the occipital sensory canal, and the median rostral series of scales flanked on each side by two or three series of scales. *C. chilensis* agrees with Okamura's characterization of subgenus *Oxygadus* except for the size of the median spinule row and by the presence of only one series of scales flanking the median rostral scale row. The species thus appears to bridge the gap separating the two nominal subgenera, and its placement is left in doubt.

The supposed presence in *Oxygadus* of a broad gap between the median and lateral processes of the nasal bone might seem to be a clear-cut distinguishing character, but *C. occa*, a species otherwise closely resembling other members of the "oxygadus-group," has median and lateral processes almost united (Fig. 20). Okamura's use, as a diagnostic character, of the number of scale rows flanking the median rostral series of scales (and separated by a narrow, naked trough from those scales next to the supranarial ridges) is of questionable value, for he himself states that *C. (Oxymacrurus) tokiensis* (Steindachner and Döderlein) has two rows on each side (the same as in species of *Oxygadus*), and my examination of two specimens (CAS–SU 22924) of *C. (Oxymacrurus) japonicus* (Temminck and Schlegel) also showed two rows (and, in fact, Okamura's (1970a: text-fig. 78) illustration of the head of that species also suggests the presence of more than one row on each side).

Based on these facts, if *C. chilensis* is included in subgenus *Oxygadus*, only two unambiguous characters remain for distinguishing *Oxygadus* and *Oxymacrurus*: 1) the relative size of the luminescent organ (length greater than half pupil diameter in *Oxymacrurus*, less than half in *Oxygadus*); and 2) the presence of a scutelike scale at the posterior end of the occipital sensory canal in *Oxygadus* that is lacking in *Oxymacrurus*. Including *C. chilensis* in *Oxymacrurus* leaves only one unambiguous character—that of the relative development of the median spinule row on the scales.

Obviously, a more thorough study is needed to clarify the relationships within and between the subgenera, and to show if they indeed represent natural groups; but that is beyond the scope of the present work. For now, it seems best to forego any subgeneric allocation of *C. chilensis*.

Distribution.—The species is known from the coasts of Peru and Chile between latitudes 6°S and 38°S, in depths ranging 260–1480 m. The 1220-m difference between its shallowest and deepest captures is considerable for a species of *Coelorinchus*, but that range is not unusual for species of other genera (especially *Coryphaenoides* and *Nezumia*). There was no correlation between latitude and capture depths of *C. chilensis*.

The species is apparently nowhere found in great abundance, although Pequeño (1971:285) reported its presence in commercial catches off San Antonio, Chile (latitude 33°34′S). The most taken in seven Anton Bruun stations (at which commercial-size shrimp trawls of about 22-m head rope were used) was 13 (station 714, in 950 m).

Material Examined (71 specimens, 11 localities). Peru:—LACM 33884–1 (1, 330 mm TL), due W of Lobos de Tierra, 06°26′S, 80°05′W, 1025 m, beam trawl, 23 Jan. 1974. Chile:—USNM 216706 (5, 51–90 mm HL, 191–335 mm TL) and CAS 38319 (8, 50–76 HL, 179–305 TL), 24°29.5′S, 70°40′W, 950 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 714 (LWK 66–60), 16 Aug. 1966.—CAS 38316 (1, 41 HL, 155 TL), 32°08.5′S, 71°43′W, 960 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 703 (LWK 66–47), 12 Aug. 1966.—CAS 38313 (5, 34–67 HL, 123–240 TL), 32°17′S, 71°39.5′W, 580 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 702 (LWK 66–44), 11 Aug. 1966.—CAS 38308 (2, 82–88 HL, 280–280 TL), 33°22′S, 71°54′W, 260–280 m, shrimp trawl, Anton Bruun cr. 18A, sta. 623A (LWK 66–16), 31 July 1966.—CAS 38311 (5, 61–78 HL, 200–300 TL), 33°39′S, 72°09′W, 1170–1480 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 699 (LWK 66–41), 10 Aug. 1966.—CAS 38309 (13, 48–95 HL, 195–367 TL), LACM 36019–1 (3, 49–58 HL, 195–210 TL), and CAS 38333 (3, 96–102 HL, 445–480 TL), 34°06.5′S, 72°18′W, 750 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 687 (LWK 66–25), 5 Aug. 1966.—CAS 38385 (9, 41–66 HL, 160–244 TL), 34°53.5′S, 72°44′W, 780–925 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 698 (LWK 66–40), 9–10 Aug. 1966.—CAS 38349 (3, 90–101 HL, 403–483 TL), 35°26.5′S, 73°01′W, 290–450 m, 22-m otter trawl, Anton Bruun cr. 18A, sta. 697 (LWK 66–39), 9 Aug. 1966.—USNM 76861 (holotype, 80 HL, 310 + TL), USNM 76890 (6 paratypes, 58–76 HL), and CAS-SU 22726 (7 paratypes, in poor condi-

tion), off Lota, 38°08'S, 75°53'W, 1238 m, ALBATROSS sta. 2791, 14 Feb. 1888.

RELATIONSHIPS OF EASTERN PACIFIC *COELORINCHUS*

The six eastern Pacific species of *Coelorinchus* each show closer affinities with species outside the region than they do with one another. The two northernmost species, *C. scaphopsis* and *C. canus*, are obviously related to three Atlantic species, *C. coelorhincus* (Risso, 1810), *C. caribbaeus* (Goode and Bean, 1885), and *C. ventrilux* Marshall and Iwamoto, 1973. They share in common the following features: 1) a well developed light organ with large dermal window between the pelvic-fin bases; 2) relatively long, narrow, tapered bands of teeth in both jaws; 3) relatively finely spinulated scales on the head and body; 4) head ridges not especially sharp and prominent; 5) subopercle terminating ventrally in a rounded tab; 6) ventral surfaces of head mostly scaled; and 7) gill opening relatively wide. *C. scaphopsis* is closest to *C. coelorhincus*, whose various populations are found throughout the Atlantic, while *C. canus* is closest to *C. caribbaeus*, whose primary distribution lies in the Gulf of Mexico and Caribbean Sea. These last two species and *C. ventrilux* have a deep notch in the ventral margin of the interopercle (Fig. 7), an elongated terminal snout scute, weakly spinulated head ridges, and thin, transparent head covering. *C. scaphopsis* and *C. coelorhincus*, on the other hand, have no ventral notch in the interopercle, a blunt, 3-pronged terminal snout scute, rather coarsely spinulated head ridges, and thick, opaque head covering.

Of the four other eastern Pacific species, two (*C. fasciatus* and *C. innotabilis*) are widespread southern hemisphere occupants and two (*C. chilensis* and *C. aconcagua*) are restricted to the Pacific coasts of Chile and Peru. *C. fasciatus* has a broad subantarctic distribution, having been taken off southern Africa, both sides of the tip of South America, off New Zealand, and off southern Australia. Based on the structure of the ventral light organ, its affinities appear to lie chiefly with other Australian macrourids, most notably with *C. mirus* McCulloch, 1926, but also with *C. aspercephalus* Waite, 1911, *C. mortoni* Ogilby, 1897, and *C. australis* (Richardson, 1839).

C. innotabilis, which ranges from southern Australia to Chile, does not appear to be closely related to any other Australian or Chilean species. Rather, its affinities are with species of the subgenus *Paramacrurus* (as defined by Gilbert and Hubbs, 1920) from the Philippines, East Indies, Japan, and Hawaii, and it seems closest to *C. cingulatus* Gilbert and Hubbs, 1920, from northern Luzon and Formosa. *C. innotabilis* is readily distinguished from *C. cingulatus*, however, by the lack of body markings so prominent in that species.

The relationships of *C. aconcagua* and *C. chilensis* are rather obscure. *C. chilensis* appears to be closest to various Indo-Pacific members of the subgenus *Oxymacrurus*, yet it shares several important diagnostic characters of subgenus *Oxygadus*, whose members are found in Hawaii, in the western Pacific, the Atlantic, and the Indian Ocean. *C. aconcagua* shares many features with *C. oliverianus* from New Zealand waters, including a similar physiognomy, huge orbits, short snout, thin head covering, relatively large mouth, wide gill openings, relatively numerous gill-rakers, and relatively weak and narrow suborbital and other head ridges. The large naked fossa of the light organ between the pelvic-fin bases and the shape of the subopercle in *C. oliverianus*, however, suggest a distant relationship for the two species. The new species may be fairly close to *C. fasciatus*, but the large fossa immediately anterior to the anus in that species contrasts with the complete absence of a naked ventral fossa in *C. aconcagua*.

ACKNOWLEDGMENTS

I thank the many persons from whom I have directly or indirectly received assistance during the preparation of this paper. I may have failed to remember some in writing this acknowledgment—for those latter my apologies for the inadvertent omission.

The following curators and their aides assisted in the loan or examination of material in their care: N. Bahamonde-N. (MNHN, Santiago), C. E. Dawson (GCRL), P. A. Hulley (SAM), E. A. Lachner and V. G. Springer (NMNH), R. J. Lavenberg, M. Ruggles, J. Newman (LACM), R. L. Rosenblatt, J. Pulsifer, J. Copp (SIO), C. L. Smith and D. E. Rosen (AMNH), D. Thys van den Audenaerde (MRAC). R. Lee (formerly with Santa Barbara Natural History Museum), F. H. Berry, and G. C. Miller provided other specimens of *Coelorinchus* for this study. I give special thanks to L. W. Knapp of the Smithsonian Oceanographic Sorting Center for allowing

study of the extensive macrourid collections of the R/V ANTON BRUUN. J. E. Fitch (California Fish and Game) provided information on otoliths.

Technical assistance was provided by T. Prudhomme (preliminary data gathering), J. E. Gordon, W. C. Ruark, K. Hakanson (X-ray and curatorial assistance), M. Giles (photography), and B. Powell (typing). Katherine P. Smith rendered the artistic, yet technically precise, illustrations.

L. Dempster and W. N. Eschmeyer critically reviewed the manuscript and offered useful advice.

This research was supported by a grant in aid of research from the National Science Foundation (BMS 7503153) to the author.

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